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THE

ELEMENTS OF THERAPEUTICS

A CLINICAL GUIDE

TO

THE ACTION OF MEDICINES

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By Dr. C. BINZ

PROFESSOR OF PHARMACOLOGY IN THE UNIVERSITY OF BONN

Translated from the Fifth German Edition, and edited, with additions, in conformity with the British and American Pharmacopœias

By EDWARD I. SPARKS, M.A., M.B. Oxon.

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON, OFFICIER DE SANTÉ (ALPES MARITIMES), FRANCE, FORMERLY RADCLIFFE TRAVELLING FELLOW

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AUTHOR'S PREFACE TO THE FIFTH GERMAN EDITION.

The arrangement adopted in former editions has been altered in the present one to adapt it to the advances of therapeutics in recent years; but the principles of teaching on which the work has been based from the beginning have undergone no change.

As a rule, I have only appended the authors' names in the case of new researches, or where I have not had sufficient personal experience on which to form an opinion of the results of the scientific investigations of others.

I have introduced only a very limited selection from the numerous toxicological discoveries which have been made of late. They are either such as already have a distinct bearing on exact scientific treatment, as promise to have such in the future, or as are already available as helps to the explanation of certain empirical facts.

TRANSLATOR'S PREFACE.

PRACTICALLY, this translation represents a new edition, a considerable amount of new matter which did not appear in the fifth German edition, having been added by Professor Binz, and a number of errors which occurred in the latter having been corrected. Nearly the whole of the proof sheets have been read and revised by Professor Binz.

I am personally responsible for the introduction of the preparations of the British and United States Pharmacopœias, of those drugs which are peculiar to these Pharmacopœias, and are not officinal in Germany, and of all articles or paragraphs enclosed in square ([ ]) brackets.

For the article on Nitrous Oxide, and for other help, I am indebted to my friend, Mr. Walter Rigden, whose large experience in the administration of anæsthetics at University College Hospital and the Hospital for Women will be a guarantee of its value.

I must also acknowledge the great assistance I have received in collating the preparations from Mr. Peter Squire's most valuable work, "The Companion to the

British Pharmacopœia," though the United States Pharmacopœia, fifth decennial revision, 1876, has been constantly consulted. Mr. W. Martindale, of New Cavendish Street, and Messrs. Coxeter, of Grafton Street East, have also rendered me material help, for which I offer my best thanks.

The metric system of weights has been retained wherever it seemed to me that the original dose could not be converted into English weight without loss of accuracy, and occasionally in other places. All educated practitioners are now more or less familiar with the relations of the two systems to each other, and there is no reason, except that founded on a dogged resistance to improvements generally, why the metric system, which has been adopted by the most influential Continental States, and which was made *compulsory* in Austria in 1876, should not become the legal standard, at any rate for medical purposes, both here and in America.*

I am rather in hope that the comparison between the British and American Pharmacopœias, which this work renders possible, may lead to the simplification of both.

Those who will observe the enormous superfluity of preparations of the same drug, which exists in several instances in both, will easily understand what I mean.

November, 1877.

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* The attention of the reader is directed to the table for converting metric weights into English weights, and to the additional notes in the appendices at the end of the volume.

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THE ELEMENTS OF THERAPEUTICS.

CHAPTER I.

NERVINA DEPRESSORIA.

Nervine Medicines whose Special Purpose is to produce a Sedative Effect.

Most neurotic drugs act on certain parts of the nervous system more rapidly and distinctly than upon others, or else they affect some part of it very violently, and the rest not at all. Probably this is due to differences in the chemical affinities of these parts. The tissue of the individual nervous centres and cerebral organs varies in its chemical constitution with the peculiar function which it subserves, and we must therefore conclude that the property which each organ possesses of attracting to itself the minute quantity of any neurotic medicine which is circulating in the blood, and of undergoing modification thereby, in the sense of being either stimulated or paralysed by it, varies in a definite way, as the function of every such organ varies.

The cells of the *cerebral cortex* have a decided affinity for the chief constituent of the first substance with which we have to deal, namely,

Opium.

The inspissated juice which exudes from the unripe capsules of *Papaver Somniferum* (Papaveraceæ). Formerly only the opium which came from Smyrna was officinal. The drug appears in commerce in the shape of small cakes or lumps which are brown both externally and on fracture. It is partly soluble in water and alcohol. It is frequently adulterated.

Opium is a mixture of several alkaloids, of which the following have medicinal names: Morphia, Codeia, Narcein, Papaverin, Narcotin, and Thebain. It also contains Meconin, an indifferent substance, and Meconic Acid, and several of the ordinary constituents of plants such as gum and resin, &c.

The quantity of these different alkaloids in any given sample of opium is very variable. The German Pharmacopœia stipulates that the opium used in medicine shall contain at least *ten per cent.* of the most important alkaloid, viz., morphia.

Action.—Morphia is the representative of opium. Its primary action on the mucous membranes and other tissues deprived of their epithelium, is, like that of all other alkaloids, irritant; but it may produce local narcotism if applied for a long period. *Internally*, when given in small doses, it causes transient excitement, but in large ones, it very quickly stupefies and paralyses, and its effects are slow in passing off. Its most marked property is that of paralysing the organs of sensation and perception, and it may be stated in general terms that the more highly organised the nervous system of any animal is, the deeper, and the more decided, is the narcosis which the drug induces. A frog, for example, can tolerate, without being killed, a quantity of morphia which quickly stupefies a man. The sleep which follows a dose of morphia is a relatively uncomplicated one, that is to say, it is not preceded or accompanied by specially unpleasant symptoms, as in the case of most of the other narcotics. Nausea and vomiting, however, are not uncommon at its commencement if the morphia is quickly absorbed. The pupil is contracted, and after poisonous doses, is reduced to the size of a mere point. It has been further proved that morphia can diminish the activity of the respiratory centre situated in the *medulla oblongata*. The respirations become at the outset quieter and slower. The functions of the spinal cord and its appendages are impaired by moderate doses. The striped muscular tissue is but slightly affected. In small and medium doses morphia stimulates the whole vaso-motor nervous system (Gscheidlen), the special result being contraction of the arteries and increase of the blood pressure. The frequency of the pulse is also usually increased. Large doses, as we might expect, cause general paralysis in proportion to their strength. After a large, but not necessarily fatal, dose there is a fall of temperature, probably due to the influence of the drug on the respiration. In animals thus narcotised the injection of putrid fluids produces no fever (Manasseïn). Morphia diminishes sensibility and movement in the human intestinal canal, but does not, as far as is known, affect its secretions. There is scarcely any alteration in the quantity of urea excreted, even when given in large doses (to dogs), while there is a distinct diminution in that of the carbonic acid, indirectly due to the restriction of muscular activity (von Boeck and Bauer). Large doses of morphia impair the power of the *detrusor urinæ*, and probably also the dilating action of the *sphincter vesicæ*, which is innervated from the spinal cord (Masius); in this way there may be complete arrest of the functions of the bladder. Long continued use of the drug sometimes gives rise to persistent itching of the skin. Like most other alkaloids part of the morphia passes unaltered into the urine. When opium is given *as such* the other alkaloids above mentioned exert their influence. They

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(5.) *Pulvis Cretæ Aromaticus cum Opio*, B.P. (1 in 40). *Dose*, gr. x.—xl.

(6.) *Pulvis Kino Compositus*, B.P. (1 in 20). *Dose*, gr. v. and upwards.

(7.) { *Suppositoria Plumbi Composita*, B.P., gr. j. in each.
Suppositoria Plumbi et Opii, U.S., gr. ss. in each.

(8.) *Unguentum Gallæ cum Opio*, B.P. (1 in 14$\frac{2}{3}$).

Preparations of Morphia:—

(1.) *Morphiæ Acetas*. *Dose*, gr. $\frac{1}{8}$—ss.

(*a.*) *Injectio Morphiæ Hypodermica*, B.P. (gr. j. of acetate of morphia in ♏xij.) *Dose*, ♏j.—vj.

(*b.*) *Liquor Morphiæ Acetatis*, B.P. (a solution of acetate of morphia, containing gr. ss. in 1 fluid drachm). *Dose*, ♏x.—lx.

(2.) *Morphiæ Hydrochloras*, B.P., *Morphiæ Murias*, U.S. Hydrochlorate of morphia. *Dose*, gr. $\frac{1}{8}$—ss.

(*a.*) *Liquor Morphiæ Hydrochloratis*, B.P. (a solution containing gr. ss. of the above in 1 fluid drachm). *Dose*, ♏x.—lx.

(*b.*) *Suppositoria Morphiæ*, B.P., U.S. (Hydrochlorate of morphia) gr. ss. in each suppository.

(*c.*) *Suppositoria Morphiæ cum Sapone*, B.P. (Hydrochlorate of morphia, glycerin of starch, curd soap, starch powder), gr. ss. of morphia in each suppository.

(*d.*) *Trochisci Morphiæ*, B.P. (Hydrochlorate of morphia. gr. $\frac{1}{36}$ in each lozenge). *Dose*, 1 or 2 occasionally.

(*e.*) *Trochisci Morphiæ et Ipecacuanhæ*, B.P. (gr. $\frac{1}{36}$ Hydrochlorate of morphia and gr. $\frac{1}{12}$ ipecacuanha in each lozenge.)

(3.) *Morphiæ Sulphas*, U.S. (Sulphate of morphia.) *Dose*, gr. $\frac{1}{8}$—ss.

(*a.*) *Liquor Morphiæ Sulphatis*, U.S. (Sulphate of morphia, gr. viij., distilled water, $\frac{1}{2}$ pint). *Dose*, ʒj.—ij.

(*b.*) *Trochisci Morphiæ et Ipecacuanhæ*, U.S. (Sulphate of morphia, ipecacuanha, sugar, oil of Gaultheria, mucilage of tragacanth; gr. $\frac{1}{40}$ morphia, gr. $\frac{1}{12}$ ipecacuanha in each lozenge.) *Dose*, 1—3 lozenges.

The action of these three salts is not materially altered by the difference in the acids with which the morphia is combined; 0·01 corresponds approximately to 0·06 of pure opium as an hypnotic dose. These salts are administered as powder, pills, or in solution; also in enemata, and as a subcutaneous injection. The latter form is the simplest and most reliable. It acts quickly, and often has a direct effect on the seat of the disease, and does not injure the digestive organs.

Its disadvantages are (1) that the drug is quickly absorbed and must therefore be given in a smaller dose than by the mouth; (2) that the patients become accustomed to the injections to such a degree that it gradually becomes very difficult to leave them off; and (3) that if continued they cause severe disturbances of the nervous power and of the nutrition. These injections are therefore only suited to such chronic cases as are incurable, or to cases in which the effects of disease are less tolerable than those which the morphia induces. In such instances, as well as in transitory acute excitement of the nervous system, they render most valuable service.

In weak, anæmic persons, with whose resisting powers we are unacquainted, it is best to begin very cautiously, and not to exceed a dose of 5 milligrammes in the first injection. In consequence of the proximity of the large blood-vessels, and of the possible danger that the poison may reach the nervous centres insufficiently diluted, it is advisable, if possible, to avoid the neighbourhood of the head and neck altogether as the seat of injection.

In consequence of the very variable proportion of morphia in crude opium, it is best always to use the alkaloid itself, its most active constituent, and the only one whose properties are accurately known, whenever practicable. Owing, however, to its relatively high price it is often adulterated.

APOMORPHIA, an artificial derivative of morphia, will be found described under the head of emetics.

CODEIA, *Methylmorphia* ($C_{18}H_{21}NO_3$), is officinal in Germany. It forms yellowish white crystals with an alkaline reaction, and soluble in 80 parts of water. It has been recommended as an hypnotic and sedative in cases where morphia does not act or is badly tolerated. The dose is 0·02 *secundis horis.* The Pharm. Germ. considers 0·05 the maximum single dose—to be marked by the prescriber with (!)—, and 0·1 the maximum aggregate dose to be given in 24 hours.

The *Papaveris Capsulæ*, *Poppy heads*, the dried capsules of *Papaver Somniferum* are also officinal, but they are unsuited for rational use, owing to the morphia, which they always contain (Dragendorff), being present in very variable amount.

Preparations :—

(1.) *Decoctum Papaveris*, B.P. (Poppy heads without the seeds, boiling water; 1 in 10.) For external application, to be used warm.

(2.) *Extractum Papaveris*, B.P. (An aqueo-spirituous extract of the capsules freed from the seeds.) *Dose*, gr. ij.—v.

(3.) *Syrupus Papaveris*, B.P. (Poppy heads without the seeds, rectified spirit, sugar, boiling distilled water; 1 in 2¼ nearly.) *Dose*, ♏x.—xx. for children; ʒj. and upwards for adults.

The following two drugs are officinal as substitutes for opium :—

Cannabis Indica, *Indian Hemp* (Urticaceæ). The flowering tops of the female plant of Cannabis Sativa, variety Indica.

Preparations :—

(1.) *Extractum Cannabis Indicæ*, B.P., U.S. (A spirituous extract.) *Dose*, gr. ¼—j.

0·03—0·10 (!) of the German Extr. Cann. Ind. are said to induce sleep, without any constipating action, or unpleasant after-effects, and to be especially adapted for alternation with opium (Fronmüller).

The American Pharmacopœia also has an *Extractum Cannabis Americanæ* prepared from Cannabis Sativa. *Dose*, gr. j.—ij.

(2.) *Tinctura Cannabis Indicæ*, B.P., U.S. (Extract of Indian hemp, rectified spirit; 1 in 20.) *Dose*, ♏ v.—xx.

The Oriental narcotics, Haschisch and Churrus, are preparations of Indian hemp. The former represents a variety of extractive matters, &c., the latter consists of the exuding resin. European hemp has scarcely any hypnotic effect.

Lactuca, *Lettuce.* The leaves and flowering tops of *Lactuca Virosa*, B.P., and *Lactuca Sativa*, U.S. (Compositæ). The juice which exudes on incision when dried forms a mass resembling opium and which has a slight narcotic action. This is the officinal *Lactucarium* Pharm. Germ. and U.S., of which the dose is gr. vij.—xxx. The *Extractum Lactucæ*, B.P., is made by evaporating the inspissated juice to a consistence suitable for pills. *Dose*, gr. v.—x.

Preparation:—

Syrupus Lactucarii, U.S. (Lactucarium, ℥ j.; diluted alcohol, q.s.; percolate, ℥ viij. of tincture, evaporate to ℥ ij., and add fourteen fluid ounces of syrup.) *Dose*, ʒ ij.—iij.

Lactucin, a neutral crystalline substance extracted from the lettuce, is said *not* to be the hypnotic principle of the plant.

Belladonnæ Folia et Radix

From Atropa Belladonna, one of the Solanaceæ growing wild in England and Germany. Their *chief constituent* is *Atropia* ($C_{17}H_{23}NO_3$), which occurs in crystals of a bitter taste, and combines with acids to form easily soluble salts. In men, when absorbed into the blood in such small quantities as 0·005—0·010 gramme it excites definite symptoms of poisoning. The most constant of these are dryness of the nose, mouth, and fauces, and consequently difficulty in swallowing; dilatation of the pupils with diminution of intraocular pressure, and consequent disturbance of vision; dryness of the skin, which often becomes erythematous, increased frequency of the pulse, paralysis of the sphincter muscles, and of the muscles of the blood-vessels, occasionally retention of urine (probably from paralysis of the detrusor muscle), meteorism, great depression, and generally cerebral narcotism of late onset and invariably preceded by hallucinations and delirium. The cerebral phenomena are the most prominent in the human subject, while the others may be in part suppressed.

Atropia diminishes the irritability of many parts of the nervous system of animals in a direct manner, without perceptibly increasing it at the outset.

Thus it especially acts on the terminal fibres of the third nerve (oculo-motor), on the sensory nerves of the air passages, the heart, and the organs provided with smooth muscular fibres; on the peripheral ends of the vagus nerve going to the heart; on the motor ganglia of the heart, and the secretory fibres of the *chorda tympani*, and the sweat-glands. The influence of the vagus on the circulation, as also the functions of the sympathetic nerve, and of the glandular substance remain intact.

These facts explain the mydriasis, the absence of peristalsis in the intestines, the increased action of the heart, and the dryness of the mouth and throat, which are the most characteristic signs of the physiological effects of atropia. Mydriasis can be directly produced by applying very small quantities to the neighbourhood of the *sphincter pupillæ*, and ophthalmic surgeons make use of this property most extensively. The second property may often be rationally used when there are definite indications for it. The third has been experimentally demonstrated on animals poisoned with hydrocyanic acid, and with muscarin, the poisonous alkaloid of the red agaricus, and other similar fungi; and the fourth has been utilised to check profuse secretion of saliva, and of perspiration.

Fraser has stated that even three times the smallest usually fatal minimum dose of physostigmin does not kill if atropia be carefully given at the same time. If the proper dose be determined, atropia can partly annul the stimulating effect which physostigmin exerts on the inhibitory ganglia of the heart, but it cannot check the action of the latter on the *medulla oblongata* (Rossbach).

A 1 per cent. solution of atropia dropped on a wound on the frog's tongue causes local arrest of pus formation by producing dilatation of the arteries with consequent acceleration of the circulation and paralysis of the movements of the cells (Thoma and Zeller).

Use.—(1.) In neuralgic pain, especially when affecting the stomach, because it causes less constipation than opium. (2.) In different spasmodic states, especially in those of the circular muscular fibres, *e.g.*, in many forms of asthma. Probably its power of arresting secretion plays a part here. (3.) Empirically in epilepsy, a disease which is well known to be excited by a number of very different causes. (4.) Empirically, too, in habitual constipation and in dyspepsia, associated with sluggish bowels. Here it probably acts by overcoming the controlling effects of the splanchnic nerve. At any rate, it is a fact that it can produce profuse diarrhœa (Fräntzel). (5.) To check (*a*) salivation, and (*b*) copious sweats. For (*a*) it is best to inject about 0·001 into the subcutaneous tissue of the submaxillary region (Ebstein); for (*b*) 0·001 — 0·002 should be given internally. In a few cases it fails to act, but generally the sweats are either much diminished or else completely checked. An obstinate case of urticaria, which had resisted all other remedies, was also cured by atropia (Fräntzel). The secretion of milk is diminished by atropia (or local application of belladonna) (S. Ringer). (6.) In poisoning with fungi of the genus agaricus (Schmiedeberg and Koppe, L. Brunton), and also in opium or morphia poisoning. In the latter (according to the author's recent researches) it quickly and energetically stimulates the depressed respiratory movements, and raises the enfeebled blood pressure. This is in accordance with numerous observations on the human subject (Johnston of Shanghai and others). (7.) To diminish intraocular pressure in the most various diseases of the eyes.

Preparations—(*a*) Of the root:—

(1.) *Linimentum Belladonnæ*, B.P. (Powdered root, 20, camphor, 1, rectified spirit, 20.)

(2.) *Extractum Belladonnæ Radicis Fluidum*, U.S. (Belladonna root, glycerin, diluted alcohol; 1 in 1.) *Dose* ♏j.—v.

(*b*) Of the leaves:—

(1.) *Extractum Belladonnæ*, B.P., U.S., prepared from the young leaves and shoots. *Dose*, in pill, gr. ¼—ss.

Both the root and the leaves are used externally in Germany in company with other narcotic drugs in the form of warm compresses, to relieve pain and spasm. As the unbroken epidermis does not absorb any atropia it is probably the *warmth* which is the most efficient agent in such cases. The same is probably true of the officinal Emplastrum Belladonnæ and Unguentum Belladonnæ.

(2.) *Tinctura Belladonnæ.* (A spirituous extract of the leaves; 1 in 20, B.P.; 1 in 7¾, U. S.) *Dose*, ♏v.—xx. or xxx.

The last two preparations are not reliable, owing to the inconstant amount of atropia which they contain.

(3.) *Emplastrum Belladonnæ.* (Extract of belladonna, 3 pts., resin plaster, 3, rectified spirit, 6, B.P.; with alcoholic extract of the root, 1, resin plaster, 2, U.S.)

(4.) *Succus Belladonnæ*, B.P. (Freshly pressed juice, 3, rectified spirit, 1.) *Dose*, ♏v.—xv.

(5.) *Unguentum Belladonnæ.* (Extract of belladonna, 1, lard, 5½, B.P.; U.S., 1 in 8.)

(6.) *Extractum Belladonnæ Alcoholicum*, U.S. (Belladonna leaves ℥xxiv., percolated with diluted alcohol, until Ovi. of tincture have passed; the latter to be evaporated to a proper consistence.) *Dose*, gr. ¼—ss.

(7.) *Suppositoria Belladonnæ*, U.S. (Alcoholic extract of belladonna.) gr. ss in each.

Preparations of Atropia:—

(1.) *Atropiæ Sulphas.* Easily soluble in water and alcohol. Taste bitter. It is made by acting on the alkaloid with dilute sulphuric acid. It is the only preparation of Belladonna in ophthalmic use, and deserves the preference also for internal administration. Dose, internally, from 0·0005—0·001; externally, a few drops of a solution of 0·05 in 20·0 water. (*Vide* also preparations of Sulphate of Atropia further on.)

The dilatation of the pupil is much more decided if the salt is applied locally than if it be given internally. Samples of the sulphate which contain an excess of acid, must be rejected, as they cause pain and irritation of the conjunctiva.

(2.) *Liquor Atropiæ Sulphatis*, B.P. (Sulphate of atropia, gr. iv., distilled water, ℥j.) *Dose*, ♏j.—ij.

(3.) *Liquor Atropiæ*, B.P. (Atropia, gr. iv., rectified spirit, ʒj., water, ʒvij.) *Dose*, ♏j.

(4.) *Unguentum Atropiæ*, B.P. (Atropia, rectified spirit, lard; 1 in 60.)

Atropia has been much used subcutaneously in treating certain neuroses, but owing to the severity of some of its attendant phenomena, and especially of delirium, it is necessary to employ it in this way *with the utmost caution.*

Pills containing opium, belladonna root, and some æthereal oils, have lately been introduced, under the title of *Pilulæ Odontalgicæ—tooth pills.* They are to be pressed as firmly as possible into carious aching teeth, after the cavity has been made as clean as possible. Probably the narcotics which the pills contain arrest the toothache, and the æthereal oils decomposition and decay.

Semina et Folia Stramonii.

From Datura Stramonium, one of the Solanaceæ, cultivated and growing wild in England and Germany. The leaves and seeds are both officinal. Its *chief constituent* is *Daturin*, a body which is identical in chemical composition with atropia. In consequence the indications for its use are very similar. The leaves have long had a great reputation as a specific in asthma and spasmodic cough. Probably their effect is here due to the same property which atropia possesses, viz., that of diminishing the irritability of the sensory branches of the vagus nerve in the lungs, or else of limiting the secretions from the air passages. The latter is probably the most usual action. The preparation used is generally an ordinary cigarette covered with a stramonium leaf. This plan is very uncertain in its results, but in some cases affords immediate relief. The leaves and seeds are given internally in powder, and in the form of pills, and applied externally as compresses and ointment. *Dose* of the powdered leaves or seeds, gr. j.—ij.

Preparations—(*a*) Of the seeds:—

(1.) *Extractum Stramonii*, B.P. *Dose*, gr. ¼.

(2.) *Tinctura Stramonii.* (1 in 8, B.P.; 1 in 7½, U.S.) *Dose*, ♏ x.—xx., B.P.; ♏ v.—xxx., U.S.

(3.) *Extractum Stramonii Seminis*, U.S. (An alcoholic extract.) *Dose*, gr. ⅛—ss.

(*b*) Of the leaves:—

Extractum Stramonii Foliorum, U.S. (Stramonium leaves, alcohol.) *Dose*, gr. ⅙—j.

Unguentum Stramonii, U.S. (Extract of stramonium, lard; 1 in 8.)

Folia Hyoscyami. From Hyoscyamus Niger (Solanaceæ), growing wild in Germany and England. *Chief Constituent*, *Hyoscyamin* ($C_{15}H_{23}NO_3$)?, a body chemically and physiologically allied to atropia. Owing to the differences in the preparations which have been hitherto used for experiment it is impossible to say more. The plant was formerly much used in irritative conditions of the air passages. There is no proof of its superiority to atropia. Quite recently the pure alkaloid has been recommended in doses of 0·003—0·015 *pro die* in mercurial and senile trembling (Oumont). On the whole, our clinical knowledge of hyoscyamus is thoroughly imperfect. In ophthalmology an extract of hyoscyamus did more good than atropia in interstitial keratitis and chronic iritis (Dor.).

Preparations:—

(1.) *Extractum Hyoscyami.* (The evaporated juice.) *Dose*, gr. iij.—vj., B.P.; gr. ij.—iij., U.S.

(2.) *Extractum Hyoscyami Alcoholicum*, U.S. (Hyoscyamus leaves, alcohol, water, dilute alcohol.) *Dose*, gr. ⅙—j.

(3.) *Succus Hyoscyami*, B.P. (Fresh juice, 3 pts., spirit, 1 pt.) *Dose*, ℥ ss.—j.

(4.) *Tinctura Hyoscyami.* (1 in 8, B.P.; 1 in 7½, U.S.) *Dose*, ♏xv.—lx., B.P.; f ʒ ss.—j., U.S.

(5.) *Extractum Hyoscyami Fluidum*, U.S. (Hyosciamus leaves, glycerin, alcohol.) *Dose*, ♏v.—xxx.

Stipites Dulcamaræ. The young stalks of Solanum Dulcamara (Solanaceæ), growing wild in Europe.

Chief Constituents:—

(1.) *Solanin* ($C_{43}H_{41}NO_{16}$), which is, however, best prepared from freshly picked potato buds, since very little, if any, of it is present in the stalks of the dulcamara. It is a crystalline body with weak basic properties, comporting itself like a glucoside if heated for a long time with diluted acids.

(2.) *Dulcamarin*, also a weak base, with a peculiar bitter, and a sweet after-taste.

Action.—Solanin is said to make the breathing slower, owing to paralysis of the vagus (Clarus); also to render the pulse small and frequent, and produce congestion of the kidneys, extending even to excretion of albumen.

Its general effects are nausea, with great depression, and a stupefied state unattended by delirium. Some recent results (Husemann) are in harmony with part of the above. According to other observations (Fronmüller), in which as much as 0·90 was given at one dose, there was only nausea, transient giddiness, and sleep lasting three-quarters of an hour, and occurring at an unusual time.

There was no perceptible effect on the pulse, temperature, or respirations. Dulcamarin is still uninvestigated.

Use.—(1.) In irritation of the air passages. (2.) To excite the action of the kidneys.

Preparations :—

(1.) *Infusum Dulcamaræ*, B.P. (1 in 10.) *Dose*, ʒj.—ij.

(2.) *Decoctum Dulcamaræ*, U.S. (1 in 20.) *Dose*, ℥j.—ij.

(3.) *Extractum Dulcamaræ*, U.S. (An alcoholic extract.) *Dose*, gr. iij.—vj.

(4.) *Extractum Dulcamaræ Fluidum*, U.S. (1 in 1.) *Dose*, ♏xxx.

Herba Lobeliæ, from the Lobelia Inflata, *Indian tobacco*, one of the Lobeliaceæ. A liquid alkaloid has been extracted from it, which seems to be its active principle. According to the latest researches it is a poison which paralyses the motor nerves, the irritability of the spinal cord, the vagus, and the centre for respiration in the *medulla oblongata*.

In moderate doses it accelerates the respiratory movements by stimulating the vagus, and also increases the blood pressure (J. Otto).

Tincture of Lobelia is given in asthmatic conditions, especially in the United States. (Strength, 1 in 8, B.P.; 1 in 7½, U.S.) *Dose*, ♏x.—xxx., or ʒj.

Preparations :—

(1.) *Tinctura Lobeliæ Ætherea*, B.P. (Lobelia, spirit of æther; 1 in 8.) *Dose*, ♏x.—xxx.

(2.) *Acetum Lobeliæ*, U.S. (Lobelia, in powder, diluted acetic acid; 1 in 7½.) *Dose*, ♏v.—lx.

Its efficiency seems to be partly dependent on the conditions under which the plant is grown; at any rate, the reports founded on the use of the cultivated variety in Germany cannot be trusted, while those which deal with the wild American plant are more reliable.

[Gelsemii Radix, U.S.

The root of Gelsemium Sempervirens, Carolina Jessamine, growing on the southern coast of the United States. The so-called root consists chiefly of the underground stem and a small proportion of true root. It has a bitter taste, and agreeable flavour. An alkaloid, Gelsemin, has been extracted from it, and appears to be the active principle.

Action.—Administered to animals in the form of a tincture, it paralyses the motor centres of the brain as well as the respiratory centre in the *medulla oblongata*. Sensibility remains intact, and the irritability of the muscles and motor nerves is retained.

Death is produced by paralysis of the respiration.

Gelsemium dilates the pupil owing to paralysis of the circular fibres (Bartholow).

Use.—(1.) To control nervous irritability in fevers. (2.) In neuralgia, especially when involving the dental branches of the fifth nerve. (3.) In various spasmodic affections, dysmenorrhœa, &c. (4.) Externally, to paralyse the accommodation instead of belladonna, as the effects pass off much earlier than in the case of the latter (Tweedy).

Preparation :—

Extractum Gelsemii Fluidum, U.S. (An alcholic extract of the powdered root, of which each ounce represents an ounce of the root.) *Dose*, ♏iij.—xx.

A tincture, made by percolating ℥ij. of the dried and powdered root with f℥xx. of proof spirit, has been used in this country and in Germany. *Dose*, ♏v.—xv. *Dose* of the powdered root, gr. j.—ij.]

A certain antagonism to the alkaloids of the Solanum family, and especially to belladonna, is shown by the

Physostigmatis Faba.

Calabar Bean, derived from the Physostigma Venenosum, one of the Papilionaceæ growing in Western Africa.

Its *active constituents* are two alkaloids which have only recently been isolated from each other, *Physostigmin* and *Calabarin*, the first of which is soluble in æther, the second not (Harnack and Witkowski). Physostigmin is amorphous, reddish, and resinoid. We need only consider it, inasmuch as calabarin has tetanising properties, and is, therefore, not yet available for medical purposes.

Eserin (Duquesnel) is very closely allied to chemically pure physostigmin.

In warm-blooded animals physostigmin has been found to be a poison, which directly paralyses the motor and sensory portions of the spinal cord, while it apparently leaves the functions of the sensorium intact.

Large doses only destroy life by paralysing the respiratory centre. The heart's action is increased, either through stimulation of the excitomotor ganglia, or else of the muscle itself. Hence the arterial pressure rises, but the pulse becomes somewhat retarded; though why this happens is as yet unexplained. The vasomotor centre is weakened by physostigmin, so that small doses of it cause diminished blood-pressure up to the point at which their stimulating action on the heart asserts itself (Harnack and Witkowski). Locally applied it stimulates the *sphincter pupillæ*, so as to cause complete myosis, and it sets up increased peristaltic action of a spasmodic character in the bowel. In this case also its effect on the muscles is a direct one.

Use.—Theoretically it is adapted to check all forms of spinal irritation, and hence it has been much prescribed in tetanus, strychnia poisoning, and chorea. Unfortunately the favourable cases which have been thus treated do not prove much, since a large number of patients with tetanus get well without any treatment, and from the nature of the disease it would be very difficult to control the results by a long series of observations on various methods of treatment.

Some physicians recommend it in the dyspnœa of emphysema, its success in which is explained by its improving the atonic condition of the muscular tissue in the walls of the bronchi (Subbotin, Vötsch). It is said to act well in attacks of mania, accompanied with cerebral hyperæmia (Crichton Browne). Applied to the conjunctiva it is used in ophthalmic medicine, *e. g.*, in paralysis of accommodation.

As to its use in chronic constipation see *Purgatives.*

Preparation:—

Extractum Physostigmatis, B.P., U.S. (Calabar bean, 1 pt., rectified spirit, 5 pts.; evaporated after percolation.) *Dose*, gr. $\frac{1}{16}$—$\frac{1}{4}$, B.P.; $\frac{1}{6}$—ss., U.S.

In tetanus, gr. $\frac{1}{3}$ may be diluted with ♏x. water, and injected subcutaneously.

Aconiti Folia et Aconiti Radix (Tubera Aconiti).

The leaves and bulbs of Aconitum Napellus, one of the Ranunculaceæ growing in Alpine districts. *Aconitia* is their most important constituent, and they also contain two other bases, Napellin (*Acolyctin*) and Aconellin, the latter of which is said to be identical with narcotin.

Aconitia is a body whose chemical composition varies with the habitat of the plant, and this explains the uncertainty of all general statements as to its action.

Action.—Aconitia produces the following as its most constant symptoms: A numbed state of the sensory organs, an indefinite feeling of pain in those parts which are supplied by the fifth nerve, salivation and dilatation of the pupils, weakness of the pulse and respiration, difficulty of breathing, fibrillary twitchings of the muscles, arrest of reflex action, sleeplessness, and death, which is preceded by paralysis of the motor cerebro-spinal nerves and of the heart.

The action of aconitia has often been compared by clinical physicians to that of digitalin. The important point for us is, that when the drug is slowly absorbed there is a period in which irritation of the cardiac branches of the vagus nerve occurs, so that a sedative effect on that organ is indirectly induced (L. Lewin and others). This irritation, however, readily passes over into the opposite condition. The phrenic nerve, too, may be involved in the paralysis thus excited (Rosenthal).

Use.—This drug is sometimes recommended (1) as an anodyne in neuralgia, especially when it affects the fifth nerve; and (2) to relieve the pain and fever of acute rheumatism. Nothing definite, however, is known about it.

Preparations—(*a*) Of the leaves:—

Extractum Aconiti. (An aqueous extract of the fresh leaves and tops, B.P.; an alcoholic extract of the dried leaves, U.S.) *Dose*, gr. j.—ij., B.P.; gr. ⅙—ss., U.S.

(*b*) Of the root:—

(1.) *Linimentum Aconiti.* (Aconite root, camphor, rectified spirit, B.P. Aconite root, glycerin, spirit, U.S.; both 1 in 1.)

(2.) *Tinctura Aconiti.* (*Radicis.*) (1 in 8, B.P.; 1 in 2½, U.S.) *Dose*, ♏ v.—xv., B.P.; ♏ j.—v., U.S.

(3.) *Emplastrum Aconiti*, U.S. (Aconite root, alcohol, resin plaster, 1 in 1.)

(c) Of Aconitia:—

Unguentum Aconitiæ, B.P. (Aconitia, rectified spirit, lard; 1 in 60.)

The so-called "*Pseudo-aconitin*," or *Nepalin*, prepared from the tubers of Aconitum Ferox, when rubbed into the skin as an alcoholic solution, diminishes the sensations of touch and temperature, and it can therefore be used, and as it seems with advantage, in the neuralgia of superficial nerves (Böhm). Strength of the solution, 0·15 in 5·0 spirit. It is said at first to cause severe irritation. Internally the action of nepalin is much stronger than that of German aconitin.

Hellebori Viridis Radix, Pharm. Germ., *Green Hellebore root.* Derived from one of the Ranunculaceæ, growing wild in central and southern Germany. It contains two non-nitrogenous active constituents resembling glucosides, Helleborin and Helleboreïn, both of which are poisonous to warm-blooded animals, and cause death in large doses. The oil which the root also contains has no poisonous properties. Helleborin is the narcotic principle. When absorbed into the blood it first causes general excitement. This is followed by depression with diminished excitability of the sensorium and of the cutaneous nerves, and dilatation of the pupils. The death which follows large doses depends on paralysis of the brain and *medulla oblongata*. Its local effect on the mucous membranes is irritating, but much less so than that of helleboreïn, which, among other phenomena, excites severe vomiting and purging in the digestive tract, and sometimes ulcerative gastro-enteritis. The action of helleborin on the nervous system is, like that of digitalin, especially directed to the heart. It appears to stimulate the kidneys to increased secretion (Marmé). The use of Helleborus Niger, whose place has been taken by H. Viridis, was formerly tolerably common, but is now completely abandoned. *Dose* of the powdered root, 0·1—0·3 (!) gramme.

Veratri Viridis Radix, *American Hellebore root.* The dried rhizome of Veratrum Viride (Melanthaceæ), growing in marshy districts in the United States and Canada. It is much used in America as an antipyretic and arterial sedative, in fevers and acute inflammations. In its action on the heart it resembles aconitia. Great vascular and nervous depression may be produced by its incautious use.

Preparations :—

(1.) *Tinctura Veratri Viridis.* (Strength, 1 in 8, B.P.; about 1 in 2, U.S.) *Dose,* ℳv.—xx., B.P.; ℳiij.—viij., U.S. The effect on the pulse should be carefully watched.

(2.) *Extractum Veratri Viridis Fluidum,* U.S. (Powdered hellebore, stronger alcohol; 1 in 1.) *Dose,* ℳij.—iv.

Herba Pulsatillæ, Pharm. Germ. Derived from Anemone Pratensis and A. Pulsatilla (Ranunculaceæ). It contains the crystalline body *Anemorin* (Pulsatilla Camphor), a chemically indifferent substance, which in doses of 0·5—0·6 gr. causes death in rabbits; and also an acid. The plant paralyses the *medulla oblongata* and spinal cord, and excites irritation of the digestive tract and the kidneys (J. Clarus).

Use.—In catarrhs of the air passages complicated with spasmodic cough, and in various rheumatic and dyscrasic conditions. A tincture made from the fresh leaves is much praised as a remedy in spasmodic amenorrhœa.

On the whole we have very little scientific knowledge of the value of pulsatilla.

Rhizoma Veratri.

Radix Hellebori Albi, from Veratrum Album, one of the Colchicum order, which grows in mountain pastures, especially in the Alpine districts.

Its chief constituent is *Veratria* ($C_{32}H_{52}N_2O_8$), which also occurs in sabadilla seeds (Asagræa Officinalis), from which in England it is officinally prepared. It contains a second alkaloid, *Jervin*, about which very little is at present known.

Action.—Although veratria has no actual smell, yet the smallest amount of it, if inspired, causes severe sneezing and cough, and if the quantity exceed a certain limit, temporary hoarseness. It also irritates other mucous membranes, and causes dermatitis if long applied to the surface of the skin. In parts that are paralysed it excites an increased feeling of warmth, and a sensation of pricking and twitching.

Internally, very small doses of it cause vomiting, and frequently also diarrhœa. Death occurs with the symptoms of paralysis of the heart and *medulla oblongata.* Protoplasmatic bodies, including the white blood corpuscles, are rendered motionless even by very dilute solutions of it and are completely killed by its prolonged action.

Von Bezold sums up the poisonous properties of veratria as follows:—" On the nervous and contractile protoplasmatic substances which compose the motor nerve-fibres, on the striped muscles of the trunk and extremities, the central organs which control the automatic movements of the heart, the automatic or reflex centres which retard these movements, the terminations of the sensory nerves of the lungs and heart, and on the automatic centres of the vaso-motor nerves, it exercises, in small doses and at the outset, a strongly irritating influence, while later on it powerfully depresses and finally destroys their functional activity.

Use.—Veratria has been much recommended in the last ten years in neuralgic and spasmodic conditions, in rheumatism and gout, as well as in heart disease and inflammatory affections. The collateral symptoms of irritation which its action involves render its use unpleasant. In cases, where the less poisonous narcotic and antipyretic drugs are inapplicable or ineffective, it may do some good. Liebermeister regards it as a most reliable antipyretic, if given in a sufficiently large

dose. It often produces complete intermission of fever in cases where quinine has completely failed. Its effect is probably due to the increased arterial pressure which moderate doses cause at the outset, for this promotes loss of heat through the skin. Veratria is much esteemed as a local external remedy. Thus, in neuralgic pain involving superficial nerves, in painful rheumatic affections, and in the pain which attends various tumors, inunctions of veratria ointment are often valuable. It is not accurately made out whether the effect of the alkaloid in these cases depends on its paralysing, or its irritating properties, or merely on its power of reddening the skin.

Owing to the severe pain which it causes when applied to a wound, we must be careful not to rub it into leech bites, &c.

Preparation:—

Unguentum Veratriæ, B.P. (Veratria, lard, olive oil; 1 in 60). U.S. much stronger; 1 in 25.

The dose of veratria, if given internally, is from 0·001—0·004 (!) (gr. $\frac{1}{70}$—$\frac{1}{18}$). The alkaloid itself is amorphous, and very slightly soluble in water, but readily in dilute acids and in alcohol. It has an alkaline reaction.

Liebermeister gives 3 milligrammes in a pill every hour, until great nausea or vomiting is produced. Generally, 4—6 pills are required.

The *Tinctura Veratri albi* externally applied, is reputed to be a specific against pityriasis versicolor.

Semina et Cormus Colchici. The seeds and bulbs of Colchicum Autumnale, one of the Melanthaceæ, which grows wild in the meadows in Europe. Their chief constituent is *Colchicin*, a yellowish amorphous body, with a sharp bitter taste. It is readily soluble in water, but does not form any definite salts with acids.

Its *action* is that of a narcotic, which is irritant even in small doses, and whose local effects especially involve the stomach and intestines. The central nervous system is temporarily excited, and then paralysed. There is loss of consciousness, of sensation, and of reflex action. Neither the motor nerves nor the heart undergoes any special change. Death is due to paralysis of the respiration (Rossbach).

Colchicum has been administered empirically from ancient times in all forms of rheumatism and gout, and it is highly valued in their treatment, although there are as yet no accurate series of experiments in proof of its efficacy. It is conceivable that preparations of colchicum diminish the intensity of stimuli affecting the peripheral nerves.

Preparations—(*a*) Of the corm:—

(1.) *Extractum Colchici*, B.P. (The inspissated juice.) *Dose*, gr. j.—iv.

(2.) *Extr. Colch. Aceticum*, B.P., U.S. (Fresh corms, acetic acid.) *Dose*, gr. ss.—ij.

(3.) *Vinum Colchici*. (Colch. corms, sherry; 1 in 5, B.P.; 1 in 2½, U.S.) *Dose*, ♏ x.—xxx.

(4.) *Extractum Colchici Radicis Fluidum*, U.S. (Colchicum root, glycerin, diluted alcohol; 1 in 1.) *Dose*, ♏ij.—v.

(*b*) Of the seeds:—

(1.) *Tinctura Colchici Seminûm*. (Colchicum seeds, proof spirit; 1 in 8, B.P.; 1 in 7½, U.S.) *Dose*, ♏xv.—xxx., B.P.; ♏x.—lx., U.S.

(2.) *Extractum Colchici Seminis Fluidum*, U.S. (Colchicum seeds, glycerin, diluted alcohol; 1 in 1.) *Dose*, gr. ss.—ij.

(3.) *Vinum Colchici Seminis*, U.S. (Colchicum seeds, sherry wine; 1 in 7½.) *Dose*, ♏x.—lx.

Conii Folia. Herba Conii.

Herba Cicutæ, derived from Conium Maculatum, *Spotted Hemlock*, one of the Umbelliferæ growing wild in England and Germany. Its active constituent is the liquid *Conia* (officinal in Germany), and it contains a much smaller quantity of another crystalline alkaloid *Conydrin.*

Action.—Our present experience, which is founded on cases of accidental poisoning in men, and on experiments on animals, supplies us with the following facts, which may possibly be of therapeutic value. Conia is a poison, which specially attacks the spinal cord and its appendages. The action of the muscles is paralysed through their nervous centres, but the ends of the motor nerves are simultaneously involved, just as they are under the action of curare, the muscles themselves retaining their electrical irritability. Complete relaxation of the striped muscles ensues, which is most marked in those of the head and neck. The *orbicularis* muscle is relaxed, the movements of the eyeball are impaired, and chewing and swallowing are rendered difficult. Speaking becomes laborious and the voice hoarse, owing to the relaxed state of the laryngeal muscles. Nevertheless, the heart and respirations may continue to act normally, and sensation and consciousness may remain intact. There is no anæthesia of any part (according to J. Harley). Conia applied to the skin deprives it of feeling (Guttmann). Poisonous doses taken internally cause death by paralysing the respiration.

The clinical value of hemlock and conia has as yet been very little tested. J. Harley describes (1874) a few cases of spasmodic torticollis and epileptiform seizures, in which the *succus conii*, B.P., in doses of 7·5—15·0 several times daily, gave excellent results. Conia has also been recommended in twitching of the eyelids, and in neuralgia affecting external nerves; in both cases as an external application.

Preparations—(*a*) of the leaves:—

(1). *Conia*, Pharm. Germ. ($C_8H_{15}N$), is a strongly alkaline liquid, perfectly clear when fresh, and of a yellowish tint after keeping. It has a mouldy smell. It is soluble in water (1 in 100), and still more so in alcohol. The dose of it would be from 0·0002—0·001. We should expect from the volatility of conia that there would be none of it left in the dried plant, and this appears to be the case. It is irrational, therefore, to use anything but the fresh drug or at most the yellow alkaloid.

(2.) *Extractum Conii.* (Inspissated juice.) *Dose*, gr. iv.—viij., B.P.; gr. j.—xx., U.S.

(3.) *Extractum Conii Alcoholicum*, U.S. *Dose*, gr. j.—v.

(4.) *Tinctura Conii*, U.S. (1 in 7½.) *Dose*, ʒ ss.—j.

(5.) *Succus Conii.* (3 measures of fresh juice to 1 of spirit, B.P.; 5 to 1 U.S.) *Dose*, ♏xxx.—lx., B.P.; ʒ ss.—℥ j., U.S.

(6.) *Pil. Conii Composita*, B.P. (Extract of hemlock, 5 pts., ipecacuanha, 1 pt., treacle, q.s.) *Dose*, gr. v.—x.

(7.) *Cataplasma Conii*, B.P. (Hemlock leaves, 1 pt., linseed meal, 3 pts., boiling water, 10 pts.; for one poultice.)

(8.) *Vapor Conii*, B.P. (Extract of hemlock, 1 pt., liquor potassæ, 1 pt., distilled water, 10 pts.) Twenty drops to be inhaled at one dose.

(*b*) Of the fruit:—

(1.) *Tinctura Conii*, B.P. (Hemlock seeds, proof spirit; 1 in 8.) *Dose*, ʒ ss.—j.

(2.) *Extractum Conii Fructûs Fluidum*, U.S. (Hemlock seeds, glycerin, hydrochloric acid, diluted alcohol; 1 in 1.) *Dose*, ♏ij.—v.

Although chemically and physically very unlike the drugs which we have been hitherto considering, the following substance is so exclusively used in medicine on account of its narcotic properties, with which no other drug (except æther) can compete, that it must find a place here.

Chloroformum ($CHCl_3$).

Chloroformum Purificatum, U.S., *Chloroform*, *Chloride of formyl.* A liquid chlorinated hydrocarbon, which is manufactured from æthylic alcohol by several methods.

Action.—When directly applied to the tissues in a concentrated form it irritates them, causing excoriation and pain, especially when evaporation is prevented. When taken up by the lungs it produces a stage of excitement of the brain, heart, and respiration, which, though almost invariably present, is of different intensity and duration in different persons. This stage is followed by one of depression of the sensorium, in which the reflex organs are partially involved, and which may result in complete unconsciousness and insensibility. It is probably due to a direct action of the chloroform on the central nerve substance. The narcosis induced varies in its duration, though it generally only lasts a few minutes. Its sequelæ are also variable, the chief one being a feeling of numbness in the head, which is of different severity in different cases.

Vomiting is a very common symptom during (and after) its administration. The pupils are contracted. If the drug be inspired too long, the respiratory centre and the heart become paralyzed. The quantity necessary to produce death is so excessively variable that it is impossible to make any general statement with regard to it. Death has resulted, in healthy adults, after as little as *five grammes* had been administered, while other patients have been kept under its narcotic influence for twelve hours, or longer, without any danger. Irregularities in the breathing and in the pulse, fatty degeneration of the heart, exhausting hæmorrhages, and previous fasting must be regarded as likely to be sources of danger; still, in a number of fatal cases, neither these nor any other causes could be said to have determined the issue.

During the action of chloroform the temperature falls, owing to diminished production of animal heat. The circulation is retarded, owing to the heart's force being lowered, and the skin gives off less insensible perspiration (Scheinesson).

Use.—(1.) To produce complete narcosis in surgical operations, in tetanus, [eclampsy], hydrophobia, and similar conditions. Special attention must here be paid (*a*) to the regularity and depth of the respirations, and (*b*) to the pulse. The primary cause of death is stoppage of the respiration, for the heart continues to bêat (at any rate in animals), although irregularly and weakly, for some time afterwards.

To prolong the sleep produced by chloroform a weak subcutaneous injection of morphia given during its administration is very serviceable. Claude Bernard recommends that the injection of morphia be made about 40—60 minutes *before* the chloroform is given, and his advice is supported by many good authorities. By so doing, the stage of excitement is rendered almost *nil*, and less chloroform is needed to induce sleep than under ordinary circumstances.

(2.) To relieve the pain of inflammatory swellings and tumours, as well as of neuralgia. For this it is applied externally as a liniment or ointment. Alkaloids dissolved in chloroform are said to be easily absorbed by the skin (Parisot.)

Dose.—For inhalation, 20 drops sprinkled on a fine net permeable to the air, and repeated several times until the effect required is produced. Externally, 5—15 grammes to 30·0 lard or glycerin. The vapour can also be carried by a simple apparatus into the vagina or rectum, and allowed to act for 10—12 minutes.

Preparations:—

(1.) *Aqua Chloroformi*, B.P. (Chloroform, water; 1 in 200.) *Dose*, ℥ ss.—ij.

(2.) *Tinctura Chloroformi Composita*, B.P. (Chloroform, rectified spirit, comp. tinct. of cardamoms; 1 in 10.) *Dose*, ♏ xx.—lx.

(3.) *Spiritus Chloroformi.* (Chloroform, 1 pt., rectified spirit, 19 pts., B.P.) *Dose*, ♏ x.—lx. (1 in 13, U.S.) *Dose*, ʒ ss.—j.

(4.) *Linimentum Chloroformi.* (Chloform, 1 pt., camphor liniment, 1 pt., B.P.; chloroform, 3 pts., olive oil, 4 pts., U.S.)

(5.) *Mistura Chloroformi*, U.S. (Purified chloroform, ℥ ss., camphor, gr. lx., the yolk of one egg, water f ℥ vi.) *Dose*, ℥ ss.—j.

The German Pharmacopœia gives the following directions for testing the purity of chloroform:—Distilled water when shaken up with it ought not to change the colour of litmus paper, or to give any cloud with nitrate of silver. A five *per cent.* solution of iodide of potassium ought not to be reddened if chloroform is dropped into it. The above tests do not suffice to detect the presence of certain heavier carbohydrides. This is best done by soaking a piece of filtering paper in the chloroform and observing whether any odour remains the moment after the latter has completely evaporated.

Iodoformum (CHI_3).

Iodoform, U.S. Bright yellow hexagonal plates, insoluble in water, but dissolved by 80 pts. alcohol and 20 pts. æther. It volatilises from boiling water. One way of making it is to carefully heat iodine and alcohol with a solution of an alkali, or alkaline carbonate.

Action.—In animals it does not cause sleep either when introduced into the stomach, or when they are allowed to inhale the vapour which results from the free evaporation of large quantities. Its poisonous effects, if administered in excessive doses, appear to depend on iodine being set free in the tissues. It is of course true that the animals may be in a stupefied state for some time previous to death. In men it has proved valuable in certain irritative conditions of the brain and spinal cord. The perspiration of the patient smells of it. Since it contains nine-tenths of its weight of pure iodine, while it does not irritate the tissues like the metalloid, it has been much used in cases in which the latter was indicated. As an external application, its sedative and discutient effects on many painful tumours have been much praised. It has also acquired a reputation in the treatment of fissures *in ano*, to relax the sphincters, and lessen the pain. In uterine disease it is of value, but it is most highly spoken of in syphilitic ulcerations.

Within the body, iodoform is absorbed and decomposed, for the urine gives a strong iodine reaction even after a dose of 3 gr. (Siegen). It also gives off free iodine when in contact with rancid oil. Probably it does the same when applied to an ulcer.

Dose.—From gr. $\frac{1}{3}$—ij., and more *pro dosi*, and up to gr. xiss. *pro die*, given in the form of powder, pills (with liquorice), or dissolved in spirit or oil. Externally as ointment, glycerole, or suppository (1 in 10).

Chloral Hydras (C_2Cl_3HO,H_2O).

Chloral Hydrate. A dry, transparent, colourless, crystalline body, with an aromatic smell and a somewhat bitter taste. By the action of strong alkalies it breaks up into chloroform and a formiate. The alkalescence of the fluids of our body is (partly owing to the presence of free carbonic acid) too weak to effect this. In the urine it appears as chloral hydrate and not as chloroform (L. Hermann).

Action.—Very similar to morphia when given in small doses several times repeated, or in a single equivalent large dose. It diminishes the irritability of the nervous centres of animal life without any bad collateral symptoms, and produces sleep without congesting the brain. Here, too, the nerve cells are directly affected. The stage of excitement is absent or else is of very short duration. The pulse and respirations become somewhat more tranquil; the pupils are only slightly contracted. Sensibility is not nearly as much diminished as it is in the sleep of chloroform. Large doses paralyse the vaso-motor centres; the arterial pressure falls, but the heart appears to lose none of its force. Death is due to respiratory paralysis. Its aqueous solution is somewhat caustic, but if sufficiently diluted chloral neither disturbs the digestion nor the action of the bowels.

Use.—In all conditions where there is sleeplessness, whether accompanied with fever or not. Also in the various forms of spasm, and especially in general convulsions which depend on direct disturbance of the central nervous system, but it is contra-indicated in hysterical convulsions owing to the initial excitement which is so often present. It is best to avoid it also, or else to give it with great caution, in ulcerations of the *primæ viæ*, in gouty states, in typhoid fever, and in disturbances of the circulation (Liebreich).

Dose.—As a sedative 0·3—0·6 several times a day; as an hypnotic in children under four years (who tolerate it much better than morphia) 0·05—0·5; to older children up to 1·5; to adults, 2·0—3·0; in states of severe excitement (tetanus, delirium tremens) the maximum of a single dose should be 4·0, which under special circumstances may be followed by 0·5 every hour. It is best given in an aqueous solution with gum or syrup, and may be introduced either by the mouth or the rectum.

In giving large doses, we should be especially careful that the solution has a neutral reaction, and that when tested with nitrate of silver and a drop of nitric acid it shows no trace of chloride of silver. Owing to the presence of bad preparations in commerce, it is as well to pay attention to the tests of its purity, which the pharmacopœias give.

Preparation:—

Syrupus Chloral, B.P. (Chloral hydrate, syrup, water; 10 grains in each drachm.) *Dose*, ʒ ss.—ij.

Butylchloral ($C_4H_5Cl_3O$), till quite recently erroneously termed crotonchloral ($C_4H_3Cl_3O$), is also a new narcotic.

One method of preparing it is to act upon aldehyd with chlorine. It forms foliaceous crystals which are volatile when heated, and have a burning taste. It is soluble with difficulty in cold water, more readily in warm, and dissolves quite readily in alcohol. It ought not to contain any chlorine which can be precipitated by nitrate of silver. Its first effect is to produce anæsthesia of the head, the rest of the body retaining its sensibility. This stage is followed by loss of function in the spinal cord, as evidenced by the general cessation of reflex irritability. The respirations and pulse remain unaffected. Still larger doses paralyse the *medulla oblongata.* Butylchloral, therefore, possesses the property of deeply narcotising the brain without materially affecting the functions of the rest of the organism. Chloroform and chloral, on the other hand, cause general anæsthesia concurrently with deep cerebral narcosis, and hence are much more likely to cause injury to the respirations and the heart, than the butylchloral (Liebreich). For reasons based on other experiments and observations, it has been recently denied that butylchloral really has these advantages (von Mering). It is given in doses of 0·2—0·3 several times quickly one after another, until 1·0 has been taken. 4·0 in one dose are said to send an adult into a deep sleep in 15—20 minutes, and at the same time to cause complete anæsthesia of the cutaneous nerves of the head. It is given in the form of pills, or else dissolved in water or glycerin.

For several years before chloroform was discovered the only drug that was used to produce complete narcosis was

Æther ($C_4H_{10}O$).

Æthylic Æther, Æthylic Oxide. Prepared by heating a mixture of spirits of wine and a little sulphuric acid, when water and æther distil over. It does not mix with water, but is slightly soluble in it; it mixes readily with alcohol.

Its *action* differs very slightly from that of chloroform. If administered in the same way it takes longer to induce narcotism and its effects pass off more rapidly. Chloroform is also preferred from its pleasanter smell. On the other hand, æther has a less dangerous action on the heart and respirations. In dogs, whose brain is exposed, the vigorous inhalation of æther soon renders that organ completely insensible to the electrical current (Hitzig). A strong spray of æther renders the external skin temporarily insensible (owing partly to the cold its evaporation produces).

The habitual use of æther ruins the digestion, and causes chronic disturbances of the nervous system (Martin, A. Ewald).

After introducing æther into a dog's stomach, Claude Bernard observed an immediate secretion of a large quantity of pancreatic juice. There was vascular congestion of the intestine, and its secretions became more abundant, while absorption was accelerated. The chyle vessels were strongly injected, which must be explained by the abundance of pancreatic juice present in the bowel, the fine subdivision of the fat thus produced, and the consequently increased facility with which it could be absorbed.

If the blood be examined after about 20 drops of æther have been taken, the colourless corpuscles in it are found to be twice or three times as numerous as usual. It is probable that here also æther has a direct action on the abdominal glands, and especially on the spleen.

Use.—(1.) To produce general narcosis in painful operations. It is preferable to chloroform if the patients have to be kept asleep for a long time, and also if any danger is to be apprehended from the weakness of the patient or the presence of heart disease.

(2.) To relieve spasm in painful affections, especially such as are connected with the abdominal or pelvic organs. Its action here is due to its permeating the tissues, and directly affecting the irritated nerves. *Dose*, ♏x.—xl. on sugar or in some mucilaginous vehicle so as to avoid local irritation.

(3.) To cause insensibility of the skin by being forcibly pumped over it with a spray apparatus. The effect depends on the cold produced, and on the penetration of the æther into the part to be benumbed. For this purpose only pure æther, quite free from alcohol, is to be used. Its power is much enhanced by simultaneously cutting off the blood supply from the part.

In small doses, æther can be used as a *stimulant.* Repeated injections of one cubic centimetre under the skin are highly spoken of (Zuelzer). All the symptoms of collapse soon afterwards disappear. The injections are not followed by abscesses. In using æther, one must always remember that it is *very combustible, and that when mixed with air and lighted it explodes.*

A mixture of æther and alcohol (1 in 3), is officinal as *Spiritus Ætheris*, B.P., *Liquor Anodynus Hoffmanni*, *Hoffmann's Drops. Dose*, ♏xxx.—lx.

Its action will be understood from the foregoing.

[The *Spiritus Ætheris Compositus*, U.S., is of the same strength as B.P., but contains æthereal oil in addition.]

Acetic Æther is also prescribed. It is the acetate of æthyl, and prepared by distilling acetate of soda with alcohol and sulphuric acid, in which process the acid combines with the soda, and the volatile acetic æther passes over. It is soluble in 11 pts. water. Clinically, it closely resembles pure æther, but is more agreeable owing to the refreshing smell which the acetic acid gives it. It increases the number of white cells in the blood just as æther does. *Dose*, ♏xx.—lx.; B.P. only.

[**Æther Fortior,** U.S., is prepared by drying ordinary æther with chloride of calcium and caustic lime, and distilling it. Its sp. gr. must not exceed 0·728.

Æther Purus, B.P., is prepared in the same way, but has the sp. gr. 0·725. Used for anæsthetic purposes.]

Spiritus Ætheris Nitrosi, made by distilling nitric acid with alcohol, in the presence of sulphur acid and copper. It is mainly nitrite of æthyl dissolved in spirit, and as far as we know anything of it, it is supposed to be a diuretic [and diaphoretic]. *Dose,* ʒ ss.—ij.

Oleum Æthereum, U.S., is a transparent volatile liquid, with an aromatic smell and sharp bitter taste; it has the sp. gr. 0·91, and is prepared by distilling stronger alcohol with sulphuric acid, washing the oily part of the distillate with distilled water, and diluting with an equal volume of stronger æther. It is used in the preparation of Spiritus Ætheris Compositus.

Æthylenum Chloratum ($C_2H_4Cl_2$), Pharm. Germ.

Bichloride of Ethylene, Chloride of Ethyl, Dutch Liquid. A colourless liquid, smelling like chloroform, made by acting on alcohol with sulphuric acid and heating the ethylene produced (the constituent of coal gas which burns with a bright flame, and has a strongly narcotic action) with chlorine. It has been especially recommended as a local anæsthetic in neuralgia and inflammations. Internally, it has been superseded by chloral. Certain pains, *e.g.*, those in the joints in acute rheumatism, are alleviated by it, and can be removed for several hours (J. Meyer). 0·5—2·0 should be rubbed into the painful part, and then covered as accurately as possible with some impervious material, so as to give the vapour every chance of penetrating the skin. An ointment of 1 pt. to 5 pts. of lard is said to act efficiently.

Chloride of Ethylene is isomeric with the foregoing. It is sometimes called bichloride of ethylene. It is made by distilling aldehyd with chloride of phosphorus, or chlorine with chloride of æthyl. It is distinguished by its lower boiling point and greater volatility. It is said to have the following advantages over chloroform, which it resembles in its ultimate action, namely, a pleasanter smell, the power of producing narcosis more rapidly, as well as without excitement or vomiting, more rapid recovery without after-effects, and altogether less danger. The dose for children, from two to three years old, was found to be about 4·0 grammes as an inhalation (Steffen). Adults require four or five times as much. It is not officinal.

Amyl Nitris, B.P., **Æther Amylo-Nitrosus**, PHARM. GERM. ($C_5H_{11}NO_2$).

Nitrite of Amyl. Prepared by leading nitrous acid into amylic alcohol. It is a very volatile fluid, at first colourless and afterwards yellowish, with a smell which resembles that of decaying pears, yet which is not disagreeable. It is insoluble in water.

Action.—Even if only a few drops are inhaled, it produces relaxation of the blood-vessels, a fall in the blood-pressure, and if the inhalation is continued longer, giddiness and insensibility. There is no preliminary stage of excitement. The effect on the blood-vessels is distinctly shown after a few seconds by the intense redness of the face and throbbing of the carotids which ensue. The pulse becomes fuller, being rendered more frequent by small doses, and retarded by large ones, and the breathing becomes somewhat easier. The congestion of the skin diminishes rapidly towards the extremities, and can scarcely be recognised at all, even as low down as the groin. The effect of the drug is not dependent on the brain or the *medulla oblongata*, since it occurs after their connection with the spinal cord has been severed. It is mainly due to direct action on the peripheral nerves of the vessels or their coats. When the inhalation is suspended, the congestion, as far as is visible externally, subsides again in about half a minute. The temperature of the body falls slightly; but there is no alteration in the vital capacity of the lungs, or in the amount of blood in the retinal vessels.

Convulsions can be excited in animals by direct electrisation of the brain. They can be lessened, or quite prevented, by the simultaneous inhalation of nitrite of amyl. The vascular dilatation can in this case be directly observed. Diabetes can be temporarily set up in rabbits by subcutaneous injections of the nitrite in fairly large doses (Hoffmann).

Use.—Nitrite of Amyl in the form of an inhalation (2—10 drops sprinkled on a handkerchief), is of service in many kinds of asthmatic attacks by at once rendering the breathing deeper and freer, and it is specially valuable in the neuralgia of the heart, which has been described as *angina pectoris.* It has also been used in epilepsy, eclampsy, hemicrania, certain cardiac pains, dysmenorrhœa, and similar affections, though in the majority of these the benefit was only transitory. There is no doubt that the new drug materially allays diseased conditions like the foregoing which depend on, or are complicated by, vascular spasm or too high a vascular tension. In tetanus its action is somewhat depressing. In severe epileptic and epileptiform convulsions its efficacy chiefly depends (apart from the primary share of the vessels in their causation), upon the length of the initial stage. If the convulsions have already begun, the effect of the æther is in most cases very doubtful, though the patient is said to recover his consciousness earlier than if it is withheld. If, however, an *aura* of moderate duration be present, the drug often absolutely arrests the fit. The statement that acute poisoning by chloroform quickly yields to nitrite of amyl (Bader, Schüller) is an important one. The effect is explained by the analeptic influence of the nitrite on the pulse and respiration.

Owing to the powerful action of the drug, care is necessary in its use in all cases treated with it for the first time. Not more than one drop should be inhaled at first; the quantity being gradually increased, if need be, later on. No bad after-effect has been as yet noticed. All poisonous action is quickly over, since the nitrite is probably rapidly decomposed in the blood, and the patient is protected from his attack for some time. Only such a preparation should be used as has no unpleasant smell, as volatilises without residue in a few seconds, and as has a neutral or only a weak acid reaction. If necessary, the boiling point (97—98° Cent.), or what is easier, the specific gravity (0·877), can be determined.

Potassii Bromidum (KBr.).

Bromide of Potassium. In crystals like those of common salt, easily soluble in water.

Action.—In healthy adults small single doses of it up to 5·0 produce no effect. Doses of 15·0 caused salivation, eructations, nausea, headache, a feeling of heat in the face, a smaller and less frequent pulse, desire to pass water, lumbar pains, colic, diarrhœa, difficulty of breathing, and depression, but no inclination to sleep. All these symptoms, except the gastric disturbance, had passed off on the next day (Amburger). Its long continued administration, even in moderate doses, generally causes erythema and acne, mainly involving the hairy parts of the body. Healthy animals exhibit the symptoms of potash poisoning when treated with the bromide. Clinical researches, such as have only been set on foot, in Germany at least, on a large scale in the last two years (Stark, Otto, and others), have elicited the following points:—Bromide of potassium in not too small a dose frequently diminishes the number of epileptic fits, by reducing the abnormal irritability of the nervous centres (*Pons Varolii*). As soon as the organism has become accustomed to it, or as soon as the drug is left off, in the majority of cases the symptoms return as before, or sometimes with more severity than before the medicine was tried. Still, the general results are favourable, and as many as 40 per cent. of the cases are permanently cured (A. Otto). The bromide has also a good effect on the nervous troubles (psychoses) which complicate epilepsy, as well as on other kinds of mental disorders, such as hypochondriasis, chronic mania, the sleeplessness of the insane, and in nervous disturbances at the menstrual period. It is said often to improve neuralgia. *Chloride* of potassium has also some of the good qualities of the bromide, so that probably both elements—the potassium and the bromine—diminish reflex action, especially in epilepsy (Stark).

The other bromine salts in medical use have, according to most observers, an action inferior to that of the bromide of potassium. (*Vide* also *Potassium preparations.*)

Dose.—From 0·3—3·0 several times daily, and in certain cases up to 15·0 *pro die.* Best given in powder, or simply dissolved in water. It is generally agreed that only relatively large doses do much good. To make them tolerated by the stomach, they should be given freely diluted.

Ammonii Bromidum (NH_4Br).

Bromide of Ammonium is officinal, B.P., U.S. *Dose*, gr. v.—xx. It has been used empirically in whooping-cough, hysteria, and other nervous conditions.

The small quantities of bromine salts, which some of the German mineral waters contain (those of Münster, near Kreuznach, and others, 0·75 NaBr. in 10,000 water) probably as far as our present knowledge goes, have no share in the effects of these springs.

Zinci Oxidum (ZNO).

Oxide of Zinc, Flowers of Zinc. We know thus much about the *action* of zinc, that like all metallic substances it excites gastro-intestinal catarrh in large doses, and if its use be prolonged, disturbs the assimilative functions.

In small doses it does not produce any local injury to the digestive organs, nor does the system generally appear to be permanently affected by them. Thus 300 grammes (the total quantity taken in five months), only caused temporary hydræmia, general loss of flesh, a small thread-like pulse, diminished mental power, and other similar symptoms; and the patient's health was restored in a few weeks by simply leaving off the medicine, and adopting appropriate remedies. All that remained was the epilepsy, the condition for which all this oxide of zinc was taken by the patient on his own responsibility (Busse).

If the oxide is in solution, a frog's muscles can be completely paralysed by a few milligrammes. The heart is involved rather early. Smaller doses only weaken the movements for the time. Warm-blooded animals react to zinc salts in the same way as cold-blooded. In all the species of animals which have been experimented on, loss of the direct irritability of the muscles has been observed.

A moderate sized rabbit only required a subcutaneous injection of about 0·1 oxide of zinc to cause complete paralysis of its muscles (Harnack).

Owing to the facility with which it forms combinations soluble in water, zinc is one of the metals which is most readily excreted from the body. The oxide was detected only four hours afterwards in the milk of a goat, which had taken 1 gramme of it, and the last trace had disappeared in sixty hours (Lewald).

Use.—In most convulsive conditions in children [especially in chorea]. It is given in doses of 0·03—0·2 in powder. Larger doses readily cause vomiting. [Toleration of increased doses is gradually induced. It is valuable too in the night-sweats of phthisis; 1½—3 grains, or more, in pill h.s.s.]. If given with magnesia, its absorption is retarded.

Preparations:—

(1.) *Zinci Lactas*, Pharm. Germ., more easily tolerated than the oxide, but used in similar conditions. *Dose* up to 0·03—0·06 (!) several times daily. Has been given *inter alia* in severe neuralgic ocular pain (V. Graefe).

(2.) *Zinci Valerianas*, B.P., Zn $(C_5H_9O_2)_2$. The presence of valerianic acid is said to make it a specially good nervine, but since we only know that a special action is excited on the nervous system by the valerian oil, and not by the ill-smelling acid, the effects imputed to the valerianate are very doubtful. By adding water and a few drops of hydrochloric acid, the fatty acid is at once set free, and the same must happen in the stomach. *Dose*, gr. j.—vj., or more in powder or pills.

[(3.) *Zinci Carbonas. Carbonate of Zinc*, *Zinci Carb. Præcipitata*, U.S. A white powder. The indications for its use are similar to those of the oxide. It is chiefly used externally as an ointment ʒj. ad ℥j. Adipis, or as an addition to lotions in eczema and other skin diseases. *Dose* internally, gr. ij.—x.]

Cuprum Sulfuricum Ammoniatum, PHARM. GERM., Cuprum Ammoniatum, U.S. $(N_2H_6CuSO_4)$.

Ammonio-sulphate of Copper. An ammonium salt in which two atoms of H are replaced by one atom of Cu. Dark blue crystals, forming a clear solution with 1½ pts. of water, but a cloudy liquid with larger proportions.

It is given empirically in disturbances of the central nervous system in adults, especially melancholia, epilepsy, nervous asthma, &c.

It is said to suit torpid better than irritable constitutions.

Copper salts paralyse the striped muscles more intensely than zinc salts (Harnack). 0·05 CuO injected under the skin of a rabbit, suffice to effect this. Unsteadiness in the legs, and weakened power in walking, are the first symptoms noticed, and they gradually go on to complete paralysis.

The pulse and respirations are weakened and retarded, the pupils dilated. The sensibility appears to be retained. The direct irritability of the voluntary muscles gradually gets less and less. Death is attended with respiratory paralysis, but not with convulsions. The other nervous centres appear to remain intact.

Dose about 0·02—0·10 (!) in *pills*; gr. ⅛—j., U.S., since the salt readily gives off its ammonia in the air. It has a slight caustic effect on the stomach, and therefore may induce vomiting.

Cupri Oxidum (nigrum), Pharm. Germ., is said to be of use as an ointment (1 in 10), as a discutient in glandular swellings.

Camphoræ Monobromidum ($C_{10}H_{15}BrO$).

Monobromide of Camphor (not officinal). A very volatile body crystallising in the form of beautiful white silky needles. It melts at 57° Cent., and boils at 132°. It was discovered in 1862, by Swartz.

Action.—In healthy animals it reduces the number of cardiac pulsations very considerably, the rapidity of its effect being proportional to the strength of the dose administered. It also diminishes the number of respirations. It lowers the temperature considerably (2—3° Cent. or more), the depression of temperature being proportional to the dose. On the nervous system an hypnotic action has been observed in some cases (Bourneville, Lawson, Pathault).

Use.—(1.) In purely nervous palpitation, and trembling, especially when associated with hysteria. (2.) In irritability of the urinary and generative organs when unattended with any severe organic changes.

Dose.—Gr. vj.—lx. Best in the form of gluten capsules, each containing gr. iij. (0·20) of the bromide (Clin). The action of the drug is always most marked in the first few days of the treatment, hence it may be well to suspend its use for a few days from time to time, when toleration of it has been established. As a guide to the maximum dose in a particular case, it has been suggested to take the patient's temperature frequently, and to reduce the quantity given directly the temperature falls below the normal.]

CHAPTER II.

NERVINA EXCITANTIA.

NERVINE DRUGS WHOSE MAIN ACTION IS STIMULANT.

Coffeïnum ($C_8H_{10}N_4O_2$); PHARM. GERM.

Caffeïn, Theïn A body of weak basic properties derived from the seeds of Coffea Arabica, and the leaves of Thea Bohea and some other plants. It is crystalline, and soluble in about 60 pts. of water. It has a bitter taste and forms salts, which are unstable.

Caffeïn can be also artificially prepared in the form of methyltheobromine, by replacing an atom of H in the alkaloid of the cocoa bean, theobromine ($C_7H_8N_4O_2$) by the radicle methyl.

Action.—Poisonous in large doses by directly paralysing the nervous centres and the heart. In moderate doses it causes great reflex excitability, and if applied immediately to the muscles produces instant rigidity, owing to the coagulation of the myosin. In moderate doses it also increases the heart's action, both by its direct effect on the organ and also by exciting contraction of the arteries. The blood pressure and the frequency of the pulse, as well as the peristaltic movements of the intestine, are all intensified.

There is a very rapid rise of temperature, which in animals may exceed 1·5° Cent. More urea and carbonic acid are excreted, and urine secreted than in the normal state. All these symptoms are of relatively short duration. One part of the caffeïn is excreted in the urine soon after its introduction into the system, and may give rise to slight vesical irritation.

Use.—It is specially given in all forms of hemicrania, and often with decided benefit. *Dose*, 0·1—1·3 in powder or pills. The fear of giving relatively strong doses is, generally speaking, groundless, as it is only from such that we can expect any decided effect. Caffein is said to be especially valuable in that form of unilateral headache, which has been described as *hemicrania sympathico-paralytica.* If this be so, one would have to think of the contraction which the drug excites in the relaxed vessels of the brain as an important factor in the cure. In cases in which the vessels are normal, and the neuralgia is due to anæmia of the brain, its efficacy might depend on the increased supply of blood which the accelerated action of the heart must bring to the suffering nerves. As yet, however, no decided opinion can be given on this point.

In animals, the narcosis and the great fall of temperature which accompany acute alcoholic poisoning, can be decidedly lessened by moderate doses of caffein (Peretti); the sopor of morphia is also diminished by it (J. Hughes Bennett). In dropsy, it is said to do good service by improving the circulation (Botkin, Koschlakoff). Valerianate of caffein (0·1 six or eight times in 24 hours) is well spoken of in the treatment of severe hysterical vomiting (Gubler).

In using an infusion of roasted coffee the stimulating effect of its æthereo-resinous oil on the nerves must be taken into account. A cup of coffee made from about 17 grammes (255 grains) contains about 0·12 of caffein, and a cup of tea made with from 5 to 6 grammes of leaves, about the same quantity (Aubert). The alkaloid which tea contains appears to be less easily absorbed than that of coffee, owing to the very large quantity of tannic acid present. Roasted coffee, either in powder or infusion, is an excellent corrective of the taste of many drugs, *e.g.*, quinia.

Guarana paste, a body resembling chocolate, must be regarded as a preparation of caffein. It is prepared from the ripe fruit of Paullinia Sorbilis, one of the Brazilian Sapindaceæ. Beside the alkaloid, the paste contains tannin, a fatty oil, gum, &c., &c. Its *dose* is 0·5—5·0 in powder.

[In some cases of "sick" headache in young women it certainly does good.]

Folia Digitalis.

Foxglove leaves. The leaves of Digitalis Purpurea, one of the European Scrophulariaceæ. The body which has been hitherto described as *Digitalin* is a mixture. There are four main substances which can be isolated in a pure state from the leaves, and which have poisonous or else physiological properties, viz., Digitonin, Digitalin, Digitaleïn, and Digitoxin. They are all *non*-nitrogenous, and the three first are glucosides (Schmiedeberg).

Action.—If digitalis is gradually introduced into the system in moderate doses, either as an infusion or in substance, *three* stages are observed:—(1.) The frequency of the pulse diminishes, and the arterial pressure rises; (2.) Both these are abnormally low; (3.) The frequency of the pulse is abnormally high, the arterial pressure abnormally low. If large doses are given, there is no intermediate second stage. Only the first is available for therapeutic purposes, *i.e.*, that in which the heart's contractions are less frequent but fuller. The digitalis acts by stimulating the pneumogastric nerve,

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not only at its medullary centre, but also at its termination in the heart, and by directly exciting the muscles of the heart. The irritability of the latter is so much raised, that even moderate bodily movements cause a considerable increase in the blood pressure. The increase in blood pressure is partly due to contraction of the small arteries (Ackermann), and this increase must on its part react on and stimulate the vagus nerve (A. B. Meyer). Poisonous doses paralyse the vagus and the muscles of the heart, so that they cease to react to an induced electric current. In men the heart finally stops during diastole.

If commercial digitalin in doses of about 0·002 be subcutaneously injected into a person whose temperature is normal, or if 0·006 be given internally there is a rigor, and the temperature rises as high as 40° Cent. (104° Fahr.), the rise beginning from four to six hours after its administration, and lasting about twenty hours. The frequency of the pulse is proportionately increased. The pupils are dilated. The amount of urine secreted as well as its specific gravity are below the normal. All this is due to vaso-motor irritation, that is, to strong contraction of the arteries (A. Otto, and recently Sokolowski and Kraminski). If, on the other hand, digitalis is given in large doses (0·2 every two hours) in primary inflammations accompanied with fever, not only is the frequency of the pulse lowered, but also the temperature, which may even fall below the normal height. But these results are independent of one another. When they occur the local process of disease is often found to be arrested (Traube). The fall of temperature is most likely due to increased arterial pressure, so that an abnormal amount of heat is given off from the surface of the body. The pulse and temperature may continue to be affected by the drug, after its administration has been left off. This cumulative effect is due, at any rate in part, to the retention of digitalin in the circulation. Paralysis of the heart may thus be induced

The first symptom which warns us to omit the drug is irregularity in the rhythm of the pulse.

Injection of large doses of infusion of digitalis into an animal's veins causes each time contraction of the whole intestinal tract (O. Nasse).

Use.—(1.) In those violent and ineffectual contractions of the heart (*Asystolism, Delirium Cordis*) which follow carditis, relaxation of the cardiac muscles, and especially valvular disease. It is in these latter cases that if the right moment be seized the effect of digitalis is so marked. The *diuretic* action of the drug in *heart disease* is also dependent on the increase of arterial pressure which it produces, just as on the other hand the dropsy in these cases may be partly due to insufficient arterial pressure. Digitalis has no directly stimulating effects on the secretory functions of the kidneys.

(2.) In hæmorrhages, particularly those due to degenerative conditions of the lungs or bronchi. If we assume that small doses of digitalis excite the vaso-motor centre, or its peripheral organs, and so cause arterial contraction, we shall find a sufficient explanation of its indication in such cases. Digitalis is of course not suitable where a rapid effect is desired.

(3.) To relieve the special symptom in all diseases attended with a high temperature. In any case it is the least certain and least manageable of antipyretics. The fall of temperature does not begin until 36–60 hours after it has been first used (Traube). Besides this, we have to consider the injury it does to the digestion, the danger of its cumulative effect, and the uncertainty of the doses we give, the latter being due to the varying amount of the active principles which the leaves contain. "In especially severe and obstinate cases, as long as the heart's action is still strong and not excessively frequent, when quinia alone fails to reduce the temperature enough, the combination of digitalis with quinia will generally produce the desired effect. From 0·75—1·5 grammes of digitalis must be given gradually in 24—36 hours, and immediately followed by a full dose (2·0—2·5 gr.) of quinia. If we once succeed in obtaining a complete intermission in this way, quinia will generally afterwards do the work alone" (Liebermeister). It seems as if the concurrence of diminished production with increased removal of heat compels a reduction to take place, which neither alone is able to effect.

(4.) To allay states of nervous excitement, *e. g.*, the delirium of acute diseases, delirium tremens, and attacks of mania. As a rule, digitalis is very badly tolerated by the digestive organs.

Preparations:—

(1.) The powdered leaves. *Dose*, gr. ss.—ij.

(2.) *Digitalinum* (Digitalin). *Dose*, gr. $\frac{1}{60}$—$\frac{1}{30}$.

(3.) *Infusum Digitalis* (Digitalis, gr. xxx., boiling distilled water, ℥ x., B.P. Digitalis, gr. lx., tincture of cinnamon, f ʒ j., boiling water, Oss.) *Dose*, ℥ $\frac{1}{4}$—ss.

(4.) *Tinctura Digitalis* (1 in 8, B.P.; 1 in 7$\frac{1}{2}$, U. S.) *Dose*, ♏ x.—xxx.

(5.) *Extractum Digitalis*, U.S. (Powdered digitalis, alcohol, diluted alcohol). *Dose*, gr. $\frac{1}{4}$—ij.

(6.) *Extractum Digitalis Fluidum*, U.S. Digitalis, glycerin, diluted alcohol; 1 in 1). *Dose*, ♏ v.—xxx.

Bulbus Scillæ, *Scilla Maritima, Squill.* From Urginea Scilla, one of the Liliaceæ growing on the shores of the Mediterranean. Its constituents are as yet not fully worked out. The Scillitin of commerce is an amorphous extract. The Extractum Scillæ (Pharm. Germ.) acts on the nerves of the heart and on the cardiac muscles just like digitalis. Its diuretic effect depends perhaps on increased arterial pressure (Husemann.) In men, in addition to retardation of the pulse, bloody urine and violent diarrhœa have been observed (Wolfring), so that it is not impossible that moderate doses have a direct action on the kidneys.

Use.—Chiefly as a diuretic in doses of 0·1—0·3, in powder or pills, several times a day. Long keeping in the shops often renders squill inert.

Preparations:—

(1.) *Acetum Scillæ.* (Squill, dilute acetic acid, proof spirit, 1 in 8, B.P.; 1 in 7½, U.S.) *Dose,* ♏xv.—xl.; ♏xxx.—lx., U.S.

(2.) *Oxymel Scillæ,* B.P. (Acetum Scillæ, 5 pts., honey, 8 pts.) *Dose,* ʒ ss.—j.

(3.) *Syrupus Scillæ.* (B.P., Acetum Scillæ, 20 pts., refined sugar, 40 pts.) *Dose,* ʒ ss.—j. (U.S., Acetum Scillæ, 20 pts., sugar, 24 pts.) *Dose,* ♏xxx.—lx.

(4.) *Tinctura Scillæ.* (1 in 8, B.P.; 1 in 7½, U.S.) *Dose,* ♏v.—xxx.

(5.) *Pilula Scillæ Composita.* (Squill, ginger, ammoniacum, hard soap, treacle; 1 in 5, B.P.; 1 in 7, nearly, U.S.) *Dose,* gr. v.—x.

The *Syrupus Scillæ Compositus,* U.S., contains senega and tartar emetic in addition to squill. *Dose,* ♏x.—ʒj.

Ergota. Secale Cornutum.

Ergot of Rye. A diseased condition of several of the grasses, especially rye. They are the sclerotia of a fleshy fungus, *Claviceps Purpurea,* and if planted in moist earth develop into the latter. Its spores, if they fall upon a healthy ear of rye reproduce the ergot instead of the normal fruit. The active constituent has the character of an acid which is readily soluble in water. Hitherto it has only been obtained in an amorphous state (Haudelin, Salkowski). It is formed by the mycelium of the fungus out of the gluten (Buchheim). Two other amorphous bodies have been extracted from the secale, Ergotin (Wenzell), and Ecbolin. They have an alkaline reaction, and form amorphous salts with acids. Three different substances have therefore all received the name of Ergotin. Ergot also contains indifferent constituents, such as a fatty oil, and mycose (*Trehalose*), a kind of sugar.

Dragendorff, of Dorpat, has lately extracted from ergot an amorphous acid, which he calls *sclerotic* acid, and he states that it is its active principle. It has a yellowish colour, and is readily soluble in water.

Action.—In large doses (10 grammes), that of an irritant narcotic, producing vomiting, diarrhœa, giddiness, headache, depression, delirium, and even coma. In smaller doses, taken for a long period, it causes the so-called *ergotism*, an endemic disease. The phenomena in which the therapeutic use of ergot depends, have been investigated with great diligence in the last ten years, but at present the explanations given of them do not by any means agree.

According to one view, subcutaneous injections of a watery extract of ergot cause contraction of the arteries in certain vascular areæ, particularly those of the skin, muscles, bowel, bladder, *pia mater*, and spinal cord. At first, the blood pressure falls, and the heart has an insufficient quantity of blood to propel. This vascular contraction is less marked in the uterus than elsewhere, but later on the whole organ contracts. This is probably the result of the stimulus which anæmia excites in the motor centres of the uterus, which are situated either in the brain or high up in the spinal cord (Oser and Schlesinger), for after section of the latter at a certain level they cease to appear (Wernich). The contraction of the arteries induced by ergotin is independent of the vaso-motor centre, inasmuch as division of the sympathetic nerve does not materially affect it (Brown-Séquard). The sphincter muscles of the bladder are excited by ergotin, and the secretion of urine by the kidneys is increased. Most of these phenomena are further explained by the following theoretical considerations (Wernich). Ergot exerts a primary influence on the tone of the blood vessels, and especially on that of the veins, tending to lower it. The veins become considerably dilated and extremely congested with blood. The arteries thus emptied contract. The contraction of the uterus after ergot is provisionally explicable on the hypothesis that it depends on anæmia of its nervous centres high up in the spinal cord, or in the brain.

The other view (Zweifel) regards the gangrene of the limbs which occurs in ergotism as depending *not* on vascular contraction, but on mechanical injuries following on paralysis and anæsthesia. The soluble constituents of ergot are mainly a poison which paralyses the spinal cord, but which affects the heart and respirations but slightly, or very late. It is quite inexplicable in what way the uterus, *i.e.*, the spinal centre which controls it, is stimulated. The vascular contractions which various observers have described as the result of subcutaneous injections of extract of ergot are simply due to irritation of the sensory nerves of the skin, and are also produced by a number of indifferent substances.

Ecbolin and Ergotin (Wiggers) are cardiac poisons, each possessing special properties (Rossbach), but as yet they have no clinical importance.

Use.—(1.) In widwifery, to cause abortion and premature labour, and especially to increase the strength of the labour pains. Especial care must here be taken to see that the bladder can be freely emptied (Wernich).

(2.) To arrest hemorrhages in various organs. It may be given either subcutaneously or if the bleeding is parenchymatous, it may be applied locally on lint, in the form of an aqueous solution of about 1 part to 6 (Bonjean).

(3.) In some forms of paralysis of the bladder, the extract in doses not exceeding 0·25 being injected directly into the organ (Vogt).

(4.) As a local injection of the watery extract for the cure of aneurisms, varices, vascular dilatation following frost-bite, prolapsus ani, and fibrous tumours of the uterus (Von Langenbeck and others). The undoubted fact of the cure of varicose veins by ergot, which might appear paradoxical in the light of the most recent experimental explanations of its effects, is attributed by Wernich to the increased activity of the heart, which the drug excites, as well as to the secondary acceleration of the blood current which was previously almost stagnant in the diseased veins. Other authorities only admit that it acts like any other simple foreign body, by causing local irritation.

(5.) In neuralgias of vaso-motor origin (Eulenburg).

(6.) In acute mania accompanied with heat of head, contracted pupils, and throbbing carotids (von Andel), and in most cases of so-called pressure on the brain (Schüller).

Preparations :—

(1.) *Secale Cornutum*, as such, in powder, pills, or infusions in doses of 0·3—1·0 several times a day; in weak labour pains or in hemorrhages it is also to be given at intervals. *N.B.—It must always be used freshly powdered.*

(2.) *Extractum Secalis Cornuti*, Ergotin, Pharm. Germ., is prepared by extracting ergot with water, and treating the residue after evaporation with dilute alcohol. It forms a clear solution in water, and is especially suitable for subcutaneous injections. The dose is 0·1 or more. It is advisable to purify the officinal extract twice with dilute alcohol. The preparation so obtained dissolved in pure water is much better adapted for subcutaneous injections than that of the German Pharmacopœia, but of course not so well as that which is made by dialysis (Wernich).

(3.) *Tinctura Ergotæ*, B.P. (1 in 4). *Dose*, ♏xv.—lx.

(4.) *Infusum Ergotæ*, B.P. (1 in 40). *Dose*, ℥j.—ij.

(5.) *Extractum Ergotæ Liquidum*, B.P. (Ergot, æther, distilled water, proof spirit; 1 in 1). *Dose*, ♏xv.—xxx., B.P.

(6.) *Extractum Ergotæ Fluidum*, U.S. (Ergot, glycerin, acetic acid; 1 in 1.) *Dose*, ♏xxx.—lx.

The German Pharmacopœia only allows ergot to be used which is less than one year old, and even this period is too long. To be certain of success, only the fresh drug or the extract recently prepared from it should be used. The contradictory results obtained by different observers, are partly due to their disregard of the fact that the active principle of ergot readily undergoes spontaneous decomposition.

Folia Tabaci.

Tobacco, from Nicotiana Tabacum, a well-known member of the Solanaceæ. Its most important constituent is *Nicotin* ($C_{10}H_{14}N_2$), an alkaloid somewhat resembling conia, but which among other properties is more readily soluble in water.

Action.—That of an extremely violent nerve poison, which first causes excitement and afterwards paralysis. There is probably no part of the nervous system which is not thus affected by nicotin.

A detailed analysis of the symptoms is only interesting to the toxicologist. The important fact for the physician is that nicotin has a direct effect upon the ganglia and muscles of the intestine, and thus induces a tetanic condition throughout its whole length. The bowel is pale, and the small arteries are in a state of strong contraction. The latter is quite independent of the contraction of the intestine, and also of the influence of the vaso-motor centre (Basch and Oser). Trifling doses only excite increased peristaltic action of the bowel. The stage of increased activity may be followed by a period of relaxation. In this case the splanchnic nerve loses its controlling power, though it is as yet unknown whether this arises from paralysis or from the stimulus to the motor apparatus being too strong for it to resist (O. Nasse).

Use.—Tobacco is scarcely likely to be employed at the present day, except in the form of enemata in constipation, arising from, or giving rise to, paralysis of the bowel, in incarcerated herniæ, recent adhesions between portions of the small intestine, and in severe tympanites. The dose of the leaves in such cases is 0·2—1·0 infused in 100 grammes of hot water. It must be used with care, owing to its extremely poisonous action.

The latest researches (F. Heubel and Von Gorup-Besanez) distinctly assert the presence of nicotin in tobacco smoke—a fact often previously denied. It does not become decomposed during smoking, as we should, of course, have expected, owing probably to its presence in the leaves as a stable salt. From the results of recent experiments on animals we may conclude that the action of tobacco smoke on the human subject is mainly due to the nicotin. Still, in smoking, the products of the dry distillation of slowly burning tobacco have to be taken into account. They consist of resinous and fatty acids, hydrocyanic acid, and sulphuretted hydrogen, the poisonous bases (from C_5H_5N upwards) in the pyridin series, and lastly, ammonia.

Preparations :—

(1.) *Enema Tabaci*, B.P. (Tobacco leaf, gr. xx., boiling water.) For one enema, ʒ viij.

(2.) *Infusum Tabaci*, U.S. (Tobacco, gr. lx., boiling water, Oj.) Used as an injection in hernia, &c., ℥ ss.—iv.

(3.) *Vinum Tabaci*, U.S. (Powdered tobacco, ℥ j., sherry wine, Oj.) *Dose*, ♏ v.—lx.

(4.) *Oleum Tabaci*, U.S. (Prepared by the dry distillation of tobacco.)

(5.) *Unguentum Tabaci*, U.S. (Tobacco, lard; 1 to 16.) Parasiticide.

Semina Strychni.

Nux Vomica. The seeds of Strychnos Nux Vomica, an East Indian tree (Apocynaceæ). They are small, nummular, greyish-brown, excessively hard bodies.

Their important constituents are:—

(1.) *Strychnia, Strychnin* ($C_{21}H_{22}N_2O_2$), a crystalline alkaloid, whose soluble salts have an insufferably bitter taste.

(2.) *Brucia* ($C_{23}H_{26}N_2O_4$), also a crystalline base, which is bitter and more soluble in water.

Action.—In small doses, the nux vomica seeds act on the digestive organs as a powerful bitter (*vide* Amara). In large doses, they cause a feeling of formication, trembling, contraction, and stiffness in the extremities, which are soon succeeded by severe clonic and tonic spasms. The latter are brought on by any attempt at movement, or by the slightest jar or shake, owing to the enormous increase of reflex excitability. The extensor muscles suffer most. The spasms may be so continuous as to kill the animal by stopping its breathing and exhausting its nervous system. The sensorium is only slightly affected by strychnia. Even during the convulsive attacks there is generally no loss of consciousness, unless such be induced by the state of the circulation. There is usually from the first a slight sense of giddiness and oppression. The spinal cord is the part chiefly attacked. It is generally supposed that the latter is directly stimulated by the strychnia, but it is quite possible that the spinal centres which control reflex movements are paralysed by the drug, or that the normal resistance which a stimulus encounters in its transmission from one set of ganglion cells to another is in some way diminished. The same symptoms are produced if strychnia is applied directly to a part of the spinal cord which has been laid bare. According to S. Mayer, strychnia causes a rise in arterial pressure by directly exciting the vaso-motor centre, and thus inducing contraction of the small arteries. Brucia acts exactly like strychnia, except that its effects are less intense and less permanent. This difference probably depends on its being essentially less poisonous, and especially on its more rapid excretion by the kidneys.

The chemical combination of nitrate of strychnia with methyl completely alters the physiological properties of the former. Its action now resembles that of curarin, that is to say, it *paralyses* the intra-muscular nerves without affecting the irritability of the muscles. The alcohol radical has a similar action on other alkaloids.

Use.—(1.) In motor paralyses wherever situated, as long as the continuity of the nerves with their centre is not interrupted, and as long as they and the muscles still retain their functions. It is also given in primary muscular atrophy. (2.) In paralysis of sensory and sensorial nerves, and particularly in essential amauroses, in which the optic nerves are but slightly degenerated. Here it is injected under the skin of the temples. Strychnia improves the acuteness of the healthy eye, and somewhat increases its area of vision for blue and red, but not for white (Cohn and also Von Hippel). (3.) In hyperæsthesiæ. In some chronic cases its value is undoubted, and may perhaps be explained by the following facts: in frogs, large doses of strychnia paralyse sensation so severely, that stimuli as intense as those of crushing and burning, either cause no reaction at all or only do so if long continued, while on the other hand it is instantly induced by the gentlest shake (W. Busch). (4.) In chronic affections of the digestive tract, especially diarrhœa, if diet and simple tonics fail to relieve. For this purpose it is best to use an aqueous extract of nux vomica, which contains no strychnia but only brucia, the latter alone being soluble in water.

The German Pharmacopœia has an officinal *Extractum Strychni Aquosum* whose dose is from 0·05—0·2. It is not a simple bitter as is sometimes supposed, for even small doses of it cause convulsions in warm-blooded animals, owing to the presence of brucia.

Preparations—(*a*) Of nux vomica:

(1.) *Extractum Nucis Vomicæ*, B.P., U.S. *Dose*, gr. $\frac{1}{6}$—$\frac{1}{2}$.

(2.) *Tinctura Nucis Vomicæ.* (1 in 10, B.P.) *Dose*, ♏x.—xxx. (U.S., much stronger, 1 in 3$\frac{3}{4}$.) *Dose*, ♏ j.—v.

The U.S. Pharmacopœia also contains St. Ignatius's bean, the seed of *Ignatia Amara*, or Strychnos Ignatia, from the Philippine Islands, containing about 1·2 per cent. of strychnia. Preparation:—*Extractum Ignatiæ.* (An alcoholic extract.) *Dose*, gr. ss.—j.

(*b*) Of strychnia:—

(1.) Dose of the pure alkaloid, gr. $\frac{1}{30}$—$\frac{1}{12}$

(2.) *Liquor Strychniæ*, B.P. (A solution of the alkaloid in water, and dilute hydrochloric acid containing one grain in two drachms.) *Dose*, ♏iv.—x.

The U.S. Pharm. contains the *sulphate* of strychnia. *Dose*, $\frac{1}{60}$—$\frac{1}{30}$.

The German Pharmacopœia prescribes the *nitrate of strychnia*, a salt which dissolves with tolerable readiness in water, but is scarcely at all soluble in alcohol. *Dose*, 0·003—0·01 (!). The total quantity administered in twenty-four hours must not exceed 0·03—subcutaneously 0·001—0·002.

[It has been lately shown that strychnia, by increasing the arterial pressure, increases the secretion of the mammary gland—in some cases as much as fifteen-fold (Röhrig).]

Since strychnia is very slowly excreted from the body, and scarcely undergoes any change while there, it has time to accumulate in the system, and the greatest care is consequently required when it is administered for a long period.

Ammonia (NH_3).

All the preparations of ammonia have nearly the same poisonous effects on the nervous system. Their physiological properties which are available for therapeutic use are the following: they increase the frequency of the pulse and respirations, and raise the blood pressure, in both cases by directly stimulating the *medulla oblongata*, and the automatic ganglia of the heart. The motor tracts of the spinal cord are excited by ammonia salts, just as they are by strychnia, but since their action is very transient, owing to the readiness with which they are excreted, it is at present improbable that they can be used with curative effect. The same is true of their stimulating action on the pulmonary branches of the vagus nerve, which may possibly be of importance in relation to their use as expectorants.

The following preparations have each certain individual peculiarities:—

(1.) *Liquor Ammoniæ Fortior.* (A 32 per cent. solution of gaseous ammonia in water, B.P.; 26 per cent., U.S.)

Preparations:—

(*a*) *Linimentum Ammoniæ.* (1 pt. of the above with 3 pts. olive oil, B.P.; with 2 pts., U.S.)

(*b*) *Liquor Ammoniæ*, B.P.; *Aquæ Ammoniæ*, U.S. (Strong solution of ammonia, 1 pt., water, 2 pts.) *Dose*, ♏x.—xx., well diluted.

The solution of ammonia is prepared by heating a mixture of chloride of ammonium and hydrate of lime, and collecting the gas which is evolved in water. It is a powerful local irritant, and has a caustic action on the mucous membranes. Small doses stimulate the secretions of the stomach, while large ones excite severe inflammation in that organ. 0·35 gramme of the officinal *Liquor Ammonii Caustici*, Pharm. Germ. (a 10 per cent. solution), caused slight oppression of the head, especially over the forehead and temples, which increased on the dose being repeated; a further quantity of 0·65 gramme produced coughing and an increased secretion of mucus in the air passages. The pulse became slightly quickened (Wibmer).

The solution of ammonia is very little used internally at present. It is chiefly employed externally, (*a*) as an inhalation in fainting fits, &c., (*b*) in the form of liniment, and combined with other substances in the treatment of sluggish inflammation, both in and beneath the cutis (rheumatism, chilblains, &c.) It is for these purposes that the *Linimentum Ammoniæ* (Liquor Ammoniæ, 1 pt., olive oil, 3 pts., B.P.; 1 to 2 pts., U.S.) and *Linimentum Camphoræ Compositum* (see Camphora) are used.

These liniments, like other liniments and ointments, owe part of their virtue to the mechanical force which is needed for their application. Their volatile constituents may also be absorbed by the unbroken skin, and exert a further influence within the tissues themselves. There is reason for believing that the exudations for the removal of which they are chiefly used, are products of an *acid* character: if this be so, the strongly basic properties of ammonia adapt it to the formation with them of diffusible salts. It is owing to the same property that ammonia is used as a remedy for the stings of insects. Recently it has been injected subcutaneously, with apparent success, into the neighbourhood of the bites of dogs affected with rabies.

(2.) *Ammoniæ Carbonas.* Carbonate of Ammonia. A volatile white salt with a pungent odour. It is a sesquicarbonate of ammonia. Its action is similar to that of pure ammonia, but milder. Carbonate of ammonia has the chemical properties of the pure base, only it is less caustic. It has been specially recommended in the treatment of all forms of acute and chronic affections of the bronchi. *Dose*, gr. iij.—x. or xx.

As a diffusible stimulant, it is often prescribed in the form of *Spiritus Ammoniæ Aromaticus.* Sal Volatile. (Carbonate of ammonia, strong solution of ammonia, oil of nutmeg, oil of lemon, rectified spirit, water, B.P. The same with oil of lavender, U.S.) *Dose,* ♏xv.—lx., diluted.

The following preparation essentially agrees in its properties with carbonate of ammonia :—

(3.) *Liquor Ammoniæ Acetatis.* Mindererus Spirit. A solution of acetate of ammonia of sp. gr. 1·030. It is a neutral liquid with a saline taste and devoid of caustic properties. The acetate of ammonia is converted in the body into carbonate of ammonia, so that it is not likely that the general action of the solution is very different from that of the carbonate. It may, however, be given without injury in relatively larger doses than the latter, owing to its less irritant effect on the digestive organs. *Dose,* ʒ ij.—vj., B.P.; ʒ iv.—xij., U.S. It is generally prescribed as a diaphoretic, but usually in conjunction with other drugs or diluted with some warm liquid.

(4.) *Liquor Ammoniæ Citratis,* B.P. A saturated solution of citrate of ammonia is used for the same purpose as the solution of acetate of ammonia. *Dose,* f ʒ ij.—vj.

The properties of both these drugs have not as yet been scientifically investigated.

(5.) *Ammoniæ Phosphas.* Phosphate of Ammonia. A salt with a neutral or weak basic reaction, and readily soluble in water. It has been recommended as a remedy for gout and rheumatism, and in the treatment of uric acid deposits. *Dose,* gr. v.—xv., several times daily in water.

[(6.) *Ammonii Valerianas,* U.S. Valerianate of Ammonia. A white salt, in the form of quadrangular plates, with an odour of valerianic acid and a sweetish taste. Deliquescent in moist air, and readily soluble in water and alcohol. *Dose,* gr. j.—v., used as an antispasmodic.]

Spiritus Vini Rectificatus (C_2H_6O).

Æthylic Alcohol. It is formed, together with carbonic acid, and small quantities of other products, by the action of the yeast fungus on grape sugar, but it can also be made synthetically from its elements.

Action.—Externally it produces cold by evaporation. Applied to the mucous membranes it excites severe irritation owing to its affinity for water. Internally the effect on healthy persons varies very much with the quantity taken. (*a.*) Moderate doses have a stimulating effect on the brain and its appendages, and also on the heart. The frequency of the pulse and the blood pressure in the arteries are increased. Gastric digestion is improved. The effect on the nerves is a direct one, and independent of any alteration in the blood or in the circulation (Dogiel). The cutaneous vessels, especially those of the head, are dilated. The quantity of water excreted by the skin is increased. If the doses are frequently repeated, fat is deposited in the tissues. There is no appreciable alteration in the temperature of the body. The feeling of increased warmth is due to the local irritation of the gastric mucous membrane, and to the accelerated circulation in the skin. Under ordinary circumstances, alcohol thus taken is almost completely consumed in the organism. (*b.*) Larger doses, but not so large as to produce intoxication, intensify all these symptoms, and at the same time, if the individual be not habituated to their use, the temperature of the body falls on the average 0·5° Centigrade. The temperature of the head must, however, be excepted from this statement, for it rises (at any rate in animals), several tenths of a degree (Mendel). The excretion of carbonic acid and of urea is reduced, most probably owing to lessened production. All these phenomena assume greater dimensions if enough alcohol be taken to produce complete sopor, and if the excess be frequently repeated a state of acute excitement of the brain, *Delirium tremens*, ensues, accompanied with connected tissue degeneration of the liver, the kidneys, and the membranes of the brain. The fall of temperature does not depend on the action of the alcohol upon the nerve tracts which pass downwards from the brain through the spinal cord, for it occurs even if the latter be divided at the level of the last cervical vertebra. It is not, indeed, as yet clearly made out how it is caused, but we shall probably not be very far wrong in assuming that alcohol, even in non-poisonous doses, lowers the activity of those cells which are concerned in the processes of tissue change, and also that this is not the only way in which it diminishes the temperature. Thus blood, and pure hæmoglobin, which have been shaken up with air, give off their oxygen to reducing agents in the presence of only a very small quantity of alcohol more slowly than they would otherwise do. We must also take into account the increased evaporation from the surface of the body and consequent cooling from this cause, which are due to the influence of the alcohol on the heart and cutaneous circulation.

Use.—(1.) As a volatile stimulant in weakness of the digestion, the heart, and the nervous system.

(2.) To replace part of the ordinary food.

In diseases with impaired digestion and increased tissue waste, alcohol in small and often repeated doses acts as a respiratory food. Its oxidation produces warmth, and consequently vital force, which serve to maintain the most necessary functions of the organism, while the living tissues are shielded from further waste. If we consider the calorific value of alcohol, as calculated from direct experiment, we find that Favre and Silbermann, as well as Frankland, assign to it the number 7, whereas pure carbon has the value 8, and hydrogen 34·5. This means that the combustion of 1·0 gramme of alcohol evolves as much heat as would raise 7 litres of water 1·0° Centigrade. The amount of heat which will thus raise a litre of water one degree is a unit of heat, and a healthy adult man evolves about 2,200 of such units in a day. Now, if we consume 100 grammes of absolute alcohol, which is the quantity contained in about 1·0 litre of good Rhine wine, their oxidation within the body produces 700 units of heat, or *nearly a third* of the quantity which is produced by a mixed diet. It is interesting to compare other foods with alcohol, and we may take for this purpose cod-liver oil, whose calorific value Frankland has also determined, and it will serve as the representative of the fats, of which it is one of the most digestible. Its calorific value is 9·1, and a man who daily takes four table-spoonfuls, or about 50 grammes of it, will, if he digests it all, evolve from it 455 units of heat. That is to say, there will be developed from it $\frac{4}{7}$ of the heat which the combustion of 100 grammes of alcohol would produce, or, in other words, the exact quantity which 65 grammes of absolute alcohol would give out. Alcohol has the further advantage of being, when largely diluted with water, absorbed and assimilated with remarkable readiness even by weak digestive organs. It does not require nearly as much work on the part of the system as the absorption and breaking up of the fats require. Thus its value does not simply depend on the stimulus it gives to the heart and the nerves, for such a stimulus imparts no new life to either; on the contrary, the system of persistent stimulation for several weeks, which is called by many medical men a "wine regimen," would only accelerate instead of checking exhaustion, were not the passing stimulus accompanied by an overplus of vital force. This fact explains what experience has proved, namely, that if wine be continued after all other nourishment has been rejected, the organism is prevented from completely succumbing.

(3.) As an adjuvant to other antipyretic remedies, especially in fevers of septic origin.

Alcohol *remains* for a certain time in the system *undecomposed*, and during this period it exerts its antipyretic action, if given in large doses. This action is not, however, generally speaking, of long duration; yet, on the other hand, there are certain diseases—for instance, traumatic erysipelas and puerperal peritonitis—in which even large doses of quinia may completely fail, while alcohol induces a distinct fall of temperature. If, after this, quinia be readministered, it often recovers its efficacy for a long time. Even in the hectic fever of consumption the temperature is somewhat lowered by doses of 40—80 c.c. of absolute alcohol. The patients pass better nights and declare that they perspire less profusely (G. Strassburg and others). Intoxication is not likely to happen in cases of fever. As soon as the alcohol is oxidised into water and carbonic acid gas it begins to maintain the forces of the organism in the manner above described. It can, therefore, exert three kinds of influence in fevers:—(1) By temporarily stimulating nearly every part of the nervous system; (2) by lowering abnormal temperature; and (3) by helping to maintain the normal functions through sparing the waste of healthy tissues.

In giving alcohol internally it is of the utmost importance to use a *pure* drug. The most frequent and best known adulteration to which it is liable is that with fusel oil, which mainly consists of amylic alcohol ($C_5H_{12}O$). It has a similar action on the organism to æthylic alcohol, but one which is more persistent and which more readily gives rise to organic degeneration.

Alcohol is used *externally*, both pure and diluted, for various purposes: for example, to arrest profuse perspiration; as a liniment to parts which are inflamed but sluggish; to stimulate and disinfect unhealthy wounds; to disinfect the pharnyx in commencing diphtheria; as an injection into the substance of non-malignant tumours and to cause obliteration of varicose veins (Luton, C. Schwalbe); as a sedative lotion in cases of burn (Leviseur).

The officinal preparations of it are:—

(1.) *Spiritus Vini Rectificatus*, sp. gr. 0·838, B.P., 0·835, U.S., which contains from 90—91 per cent. of alcohol by volume. Its purity is tested by allowing a few drops to evaporate rapidly on the hand and observing whether they leave any odour of the less volatile fusel oil.

(2.) *Spiritus Tenuior*, B.P.; *Alcohol Dilutum*, U.S. Proof Spirit. (Rectified spirit, 5 pts., water, 3 pts., B.P.; equal pts. by volume, U.S.) Both kinds are used in the preparation of various drugs, especially tinctures.

(3.) *Spiritus Vini Gallici*, B.P., U.S. French brandy, containing 48—56 per cent. of alcohol.

(4.) *Mistura Spiritûs Vini Gallici*, B.P. (Brandy, ℥ iv.; cinnamon water, ℥ iv., the yolks of two eggs; sugar, ℥ ss.) *Dose*, ℥ ss.—iss.

In conjunction with salts, acids, various æthers, glycerin, and large quantities of water, alcohol appears in the form of wine and is often so used by the physician. In Germany three kinds of wine are officinal, *vinum generosum*, *album* and *rubrum*, and sherry, *vinum xerense*. The first two are represented by the better sorts of German wine, especially those with but slight acidity and not much æther.

The better Rhine wines contain from 8—11 per cent., Champagne from 11—14 per cent., and sherry from 17—18 per cent. of alcohol. The important ingredients of ordinary German beer are carbonic acid and hop bitter, and about 3—5 per cent. of alcohol; it also contains dextrin and starch, some sugar and albumen, various salts, especially phosphates, and a little fusel oil, which is most likely the agent to which the peculiar kind of intoxication which beer produces is due.

Beer containing 4—5 per cent. of alcohol, administered at night in doses of 1 or 2 quarts and drunk in the course of an hour to an hour and a half, has been recommended as a good hypnotic for male lunatics suffering from sleeplessness accompanied with excitement (E. Wittich).

Koumiss is the name given to a drink prepared originally from mare's milk on the Circassian steppes, but which is now manufactured in Europe. It is partly fermented, and partly in a state of fermentation, and contains, in addition to alcohol (1—3 per cent.) and carbonic acid, the ordinary constituents of milk and certain collateral products of fermentation which have not as yet been further investigated. Koumiss is said, *inter alia*, to be very valuable in the early stages of phthisis, its most frequent effect being an improvement of nutrition with decided increase of weight. About 2 litres a day are an average dose. An artificial koumiss is prepared from condensed milk, 100 grammes of which are mixed with 1·0 lactic acid, 0·5 citric acid, 15·0 of good rum or Cognac, the whole being diluted with water to 1,000 or 1,500 grammes, and saturated with carbonic acid. After the mixture has stood several days in a warm room it begins to ferment (C. Schwalbe).

CHAPTER III.

ÆTHEREO-OLEOSA (ÆTHEREAL OILS).

THE officinal æthereal oils are either pure hydro-carbons, compounds of the latter with oxygen or sulphur, or intimate mixtures of two or more such compounds. From a chemical point of view a large number of them belong to the so-called aromatic series. Many bodies which belong to the fatty series are also included under the title, while others are not as yet classified at all. A small number of other substances whose physical properties only partially resemble those of the æthereal oils—for instance, certain resinous acids—are only introduced here because they are allied to the former in their origin and have similar medicinal uses.

The general effect of the æthereal oils on the animal organism varies very much with the seat of their application, and with the dose. When applied to the skin and mucous membranes, they produce local irritation, but if brought into contact with them in the form of vapour for a long period they have a sedative action on these parts. Their great power of arresting fermentation often makes them valuable antiseptics, probably owing to the antagonistic influence which their hydro-carbons exert on the protoplasm of all those ferments which excite decay and decomposition. Experiments on animals clearly indicate the possibility of their exciting a narcotic action powerful enough to ward off tetanising influences when given internally. Both in cold and warm-blooded animals reflex excitability is lessened, not only when normal, but also when artificially increased by ammonia, brucia, or strychnia. In this we have a complete explanation of the fact that the greater number of æthereal oils and other allied substances, when they volatilise in the stomach, exert an anti-spasmodic influence on the surrounding organs. As far as investigation goes we know that if given in fairly large doses they increase the force of the heart, and that, if their activity be prolonged, they can at last paralyse that organ, as is easily proved by experiments on animals. If they are introduced into the stomach they most of them (probably owing to some direct influence on the spleen), increase the number of colourless corpuscles in the blood as much as threefold for several hours. Most of them, in doses of a few minims, appear to improve gastric digestion, but in larger quantities they decidedly impair it, and may even excite gastritis. If dyspepsia is already present they very quickly excite vomiting. Many of them reduce the secreting power of the bronchial and other mucous membranes, especially if the amount of secretion be morbidly increased; but the reason of this action is still uncertain. In the blood and the various organs of the body they are partly decomposed and partly oxidised. They are mainly excreted by the kidneys, and may excite sufficient irritation in the latter to produce hæmaturia.

I begin with that which is most employed, as the clinical representative of this class.

Camphora.

Camphor. Prepared from Laurus Camphora, one of the Lauraceæ of China and Japan, by distillation with water.

Like the other æthereal oils it is only slightly soluble in water (1 : 1000), but readily soluble in alcohol, æther, and the fatty oils.

Action.—Locally applied to the mucous membranes and to the surface of wounds it causes irritation, which may even end in inflammation. In the stomach it readily induces dyspepsia, hyperæmia, and catarrh. When taken up by the blood in small doses it causes excitement in the same way as alcohol or æther, while in larger doses it produces sopor and general convulsions, which, however (at any rate in dogs), may pass quickly away, without any after-effects, in spite of their previous severity, if the dose were only a moderately large one. The heart of animals (frogs and warm-blooded animals) which have been treated with moderate doses acts more powerfully during life and retains its irritability long after death. If the heart be paralysed by severely stimulating its inhibitory apparatus by muscarin, the paralysis so induced can be partly removed by camphor. Even doses which are not large enough to cause convulsions, or any kind of poisonous symptoms, produce a distinct fall of temperature of short duration, not only in healthy animals, but still more in those in whom fever has been excited by the injection of putrid fluids. Smaller doses do not affect the temperature at all. The temperature of an animal with fever is more easily reduced than that of a healthy animal. The effect appears to be partly due to the stimulus exerted by the camphor on the peripheral circulation. The general condition of the animal also distinctly improves after the drug is absorbed. Even a very dilute solution of camphor paralyses the movements of the white blood corpuscles. Like most bodies of its class camphor powerfully arrests the decomposition of organic substances dependent on protoplasmatic ferments.

Use.—(1.) In all infectious or inflammatory diseases which threaten to *paralyse the heart*, especially in severe forms of erysipelas (Pirogoff). (2.) In cases where the bronchial secretion is tenacious and difficult to expel. (3.) Externally, to stimulate the granulations of torpid and unhealthy ulcers; to revive the activity of relaxed or œdematous parts; and to promote absorption in subacute inflammations, as well as for some other purposes in which a stimulant treatment is required. In such cases it is often an excellent plan to wrap the swollen part closely with wadding sprinkled with powdered camphor.

Camphor sometimes causes critical sweats in cases in which it reduces severe fever, but it is not as yet decided whether the increased secretion of sweat depends on a direct influence which the camphor exerts on the skin, or whether it is indirectly due to the cessation of the fever. It is doubtful whether the specific sedative action on the sexual organs which camphor is said to have really exists.

Dose.—From 0·1—0·3 in powder or emulsion every two hours. To powder it, it should be first moistened with a few drops of spirits of wine; it is then called *Camphora trita.* It must be prescribed in wax paper (*Charta cerata*) to avoid loss by evaporation. Emulsions are most simply made with gum arabic, *e.g.*, 2·0 camphor rubbed up with a sufficiency of gum and suspended in 150·0 water.

The only reliable plan, if we wish to get a rapid action, and to repeat it frequently, is to inject a solution of camphor in oil under the skin (1 : 9 Olei Amygdal. dulc). Under ordinary circumstances, the injection is not painful, nor followed by abscess; the drug is rapidly absorbed and the digestion is not impaired, as it always is when camphor is given by the mouth.

The following preparations are adapted to external use:—

(1.) *Linimentum Camphoræ.* (Camphor, olive oil; 1 to 4, B.P., U.S.)

(2.) *Linimentum Camphoræ Compositum*, B.P. (Camphor, oil of lavender, strong solution of ammonia, rectified spirit.)

The British and American Pharmacopœias contain the following formulæ for internal use :—

(1.) *Aqua Camphoræ.* (Camphor, distilled water, 240 grs. in 8 pints, B.P.; 120 grs. in 2 pints, U.S.) *Dose*, ℥j.—ij., B.P.; ʒj.—℥ss., U.S.

(2.) *Spiritus Camphoræ.* (Camphor, rectified spirit; 1 in 10, B.P.; 1 in 7½, U.S.) *Dose*, ♏x.—xxx., B.P.; ♏v.—xx., U.S.

(3.) *Tinctura Camphoræ Composita.* (*Vide* opium, p. 7).

[**Buchu Folia**, B.P., U.S., *Buchu Leaves.* The dried leaves of Barosma betulina, crenata, and serratifolia (Rutaceæ), from the Cape of Good Hope. They contain a volatile oil, to which their effect is probably due. They are supposed to have a diuretic action by directly stimulating the kidney, but their chief use is in irritability and chronic catarrh of the bladder.

Preparations :—

(1.) *Infusum Buchu.* (1 in 20, B.P.; 1 in 16, U.S.) *Dose*, ℥ss.—ij. A good vehicle for other diuretics.

(2.) *Tinctura Buchu*, B.P. (1 in 8.) *Dose*, ʒj.—ij.

(3.) *Extractum Buchu Fluidum*, U.S. (1 in 1.) *Dose*, ♏xx.—xxx.]

Cortex Cinnamomi Zeylanici, *Cinnamon.* From Cinnamomum Zeylanicum (acutum), one of the East Indian Lauraceæ. Its æthereal oil has a stronger fragrance than that of Chinese cinnamon (*vide infra*), the price of which is six times as high. Its bark is given like that of the latter in the form of powder (0·3—0·5), with other stimulating drugs.

The bark of *Cinnamomum Cassia*, one of the Chinese Lauraceæ, is also officinal in Germany. Either bark may be used to prepare the following drugs :—

(1.) *Aqua Cinnamomi.* (Bruised cinnamon, 1 pt., water, 8 pts., B.P.; ♏j. oleum cinnamomi, to ℥j. water, U.S.) *Dose*, ℥j.—ij.

(2.) *Oleum Cinnamomi*, B.P., U.S. This is chiefly cinnamic aldehyd (C_9H_8O), and is excreted in the urine as hippuric acid. It may be administered on sugar. *Dose*, ♏j.—iv.

(3.) *Pulvis Cinnamomi Compositus*, B.P.; *Pulvis Aromaticus*, U.S. (Cinnamon, cardamoms, ginger, of each equal parts, B.P.; cinnamon, 2 pts., ginger, 2 pts., cardamoms, 1 pt., nutmeg, 1 pt., U.S.) *Dose*, gr. iij.—x.

(4.) *Tinctura Cinnamomi.* (Cinnamon, proof spirit; 1 in 8, B.P.; 1 in 10, U.S.) *Dose*, ʒj.—ij., B.P.; ʒj.—iv., U.S. The tincture has been much recommended as a stimulant in torpid conditions of the uterus [and in menorrhagia (Tanner).]

Caryophylli, *Cloves.* The flower buds of Caryophyllus Aromaticus, one of the East Indian Lauraceæ. They serve as an addition to other stimulants. The oil is officinal. *Dose*, ♏j.—iv. [Sponge tents soaked in it are less likely to cause septic poisoning than ordinary tents (Lawson Tait).]

Preparation:—

Infusum Caryophylli (1 in 40, B.P.; 1 in 66, U.S.). *Dose*, ℥j.—ij.

Fructus Lauri, Pharm. Germ., *Laurel.* The fruit of Laurus Nobilis. The *Oleum Lauri* is derived from them. It is mainly the glyceride of the fatty lauric acid mixed with a little æthereal oil and chlorophyll. Owing to its consistence it is also called *Unguentum Laurinum*, or *Laurel Butter.* It is used in Germany as an embrocation.

The freshly gathered laurel leaves, given in repeated doses of 1·0 gramme, are said to act as an efficient febrifuge (A. Doran).

Oleum Cajuputi, *Cajeput oil*, Pharm. Germ., B.P. Prepared from the leaves and capsules of Melaleuca Minor, one of the East Indian Myrtaceæ. It is colourless if quite pure, and of a green tint if unrectified, and in both forms has a smell somewhat like that of camphor. It was formerly employed in a number of diseases, but at present its use is almost entirely restricted to that of a local application in dental caries and dental neuralgia, in which it may be profitably combined with chloroform.

[In England it is chiefly used to relieve flatulent distension, in the form of the *Spiritus Cajuputi*, B.P. (Cajeput oil, 1 pt., rectified spirit, 49 pts.) *Dose*, ♏xv.—lx., and upwards. As a topical stimulant, it enters into the composition of *Linimentum Crotonis*. *Dose* of the pure oil, ♏v.—xx.]

Fructus Fœniculi.

Fennel seeds. Obtained from Fœniculum Officinale and Dulce (Umbelliferæ). They are a favourite remedy for preventing the excessive development of flatus in the bowel, or dispelling it rapidly if present.

As all such so-called *carminative* remedies appear to increase not only the secretion of the digestive fluids, but also the peristaltic movements of the muscles of the bowels, owing to the stimulus which the æthereal oil (*Oleum Fœniculi*, U. S.) exerts on the tissues and nerves of the intestine, so too the fennel seeds render good service to the physician, although he cannot claim for them any other specific influence. They are generally given in the form of *Aqua Fœniculi*, which is made by distilling the seeds with water; the distillate contains a small quantity of the oil in solution. It is used as an ingredient in stimulant medicines. *Dose* of Oleum Fœniculi, ♏v.—xv.

Preparation:—

Aqua Fœniculi. (1 pt. in 10 pts. water, B.P.; oil of fennel, ♏xv. in Oj. water, U.S.) *Dose*, ʒj.—ij., B.P.; ℥ij., U.S.

Fructus Carui, *Caraway seeds.* The seeds of Carum Carui, an umbelliferous plant, growing in Europe.

Preparations:—

(1.) *Oleum Carui*, B.P., U.S. *Dose*, ♏ij.—iv.

(2.) *Aqua Carui*, B.P. (1 in 10). *Dose*, ℥j.—ij.

Fructus Coriandri. *Coriander seed.* The seeds of Coriandrum Sativum. *Dose*, gr. xx.—lx.

Preparation :—

Oleum Coriandri, B.P. *Dose*, ♏j.—iv.

Oleum Anisi Vulgaris, *Oil of Aniseed.* The oil distilled from the fruit of *Pimpinella Anisum.* Both anise and coriander are umbelliferous European plants, and both they and caraway seeds are used precisely like those of fennel. Oil of aniseed is also an ingredient in *Tinctura Camphoræ Composita.* Its *dose* is ♏j.—iv.

Preparation :—

Essentia Anisi, B.P.; *Spiritus Anisi*, U.S. (Oil of anise, rectified spirit; 1 in 4, B.P.; 1 in 16, U.S.) *Dose*, ♏x.—xx., B.P.; ʒj.—ij., U.S.

Angelicæ Radix, *Angelica root*, Pharm. Germ. Obtained from Angelica Archangelica, an umbelliferous plant, native of the sub-Alpine European mountains. It contains an æthereal oil, a crystalline (Angelic) acid, which belongs to the acrylic acid series, as well as a bitter principle, &c., and its action resembles that of the preceding drugs. In Germany, the following preparation is officinal :—

Spiritus Angelicæ Compositus. (Angelica root, valerian root, and juniper berries, macerated together in water and alcohol, and distilled.) Some camphor is added to the distillate, which is used as an irritant embrocation.

Fructus Phellandrii, *Water Fennel seeds.* They are derived from Œnanthe Phellandrium, a European unbelliferous plant. They contain a yellow oil, which has a sharp taste and odour. It is generally prescribed as an infusion of the strength of 8·0—12·0 in 150 grammes of water. This drug is almost exclusively used as an expectorant, and very seldom even for that purpose.

Radix Pimpinellæ, *Pimpernel root.* Obtained from Pimpinella Saxifraga, a European umbelliferous plant. It contains an æthereal oil, and an acrid non-nitrogenous crystalline body. *Tinctura Pimpinellæ* is officinal in Germany, and is given in doses of 20—60 minims in commencing, as well as in chronic, angina tonsillaris, in both of which it is much valued.

Petroselini Fructus, *Parsley seeds.* The seeds of Petroselinum Sativum, the well-known Umbellifer. They are popularly reputed to have a diuretic action. Their chief constituent is an æthereal oil, in which Parsleycamphor, or apiol, is dissolved. Both these substances are but slightly soluble in water; and this fact must be considered in estimating the value of the officinal *Aqua Petroselini*, Pharm. Germ. The seeds are chiefly used as a warm infusion of 10·0 in 150·0 water. The *Petroselini Radix* is officinal, U.S. (secondary list).

Fructus Anisi. The fruit of *Illicium Anisatum*, Star Anise (Magnoliaceæ), a native of China, and of Pimpinella Anisum, growing in Europe. It is occasionally added to carminative infusions, but the æthereal oil distilled from it, and which is its active ingredient, is most often used. *Dose* of the oil, ♏j.—iv.

Radix Valerianæ.

Valerian root. Derived from the common wild Valeriana Officinalis. It contains an æthereal oil, and the well-known fatty acid as its chief constituents. The oil which is officinal in Germany and America, appears to be the active principle, and the acid is not as yet proved to have any special action. Valerian root has the reputation of being a special nervine sedative and antispasmodic, particularly valuable in hysterical affections. It has also been recommended in paralysis, and quite recently in diabetes insipidus. Dose of the powdered root, gr. x.—xxx.; of the oil, ♏ij.—iv.

Preparations:—

(1.) *Extractum Valerianæ*, U.S. *Dose*, gr. x.—xxx.

(2.) *Extractum Valerianæ Fluidum*, U.S. (1 in 1). *Dose*, ʒ ss.— ℥ ss.

(3.) *Infusum Valerianæ* (1 in 40, B.P.; 1 in 30, U.S.). *Dose*, ℥ ss.—ij.

(4.) *Tinctura Valerianæ* (1 in 8, B.P.; 1 in 10, U.S.). *Dose*, ʒ j.—ij.

(5.) *Tinctura Valerianæ Ammoniata.* (Valerian root, 1 pt., aromatic spirit of. ammonia, 8 pts., B.P.; 1 in 10, U.S.) *Dose*, ʒ ss.—j.

Valerianic acid is generally prepared from amylic alcohol, the chief ingredient of fusel oil. It is a liquid which has a disagreeable odour. It is used in medicine in combination with zinc, sodium, ammonia, and quinia.

The U.S. Pharm. prescribes the pure Oleum Valerianæ. *Dose*, ♏ iii.—v.

Herba Meliloti, *Stone Clover.* The leaves of Melilotus Officinalis, one of the European Papilionaceæ. Probably its only use at the present time is as an ingredient of the *Emplastrum Meliloti*, Pharm. Germ., in which it is combined with wax, olive oil, and turpentine, and which is employed as a discutient of glandular tumours. The active principle of the plant is probably Melilotate of Cumarin. Melilotic acid has not as yet been physiologically investigated. The crystalline body called Cumarin ($C_9H_8O_2$), which also occurs in *Asperula odorata*, sweet woodruff, *Anthoxanthum odoratum*, sweet scented vernal grass, as well as in the *Tonquin bean*, obtained from Dipterix odorata, exhibits most of the properties of the other æthereal oils.

One of the other Papilionaceæ produces the

Balsamum Peruvianum.

Balsam of Peru. A syrupy brown liquid, with a pleasant smell,derived from the Myroxylon Sousonatense,or Pereiræ, of

Central America. Its chief constituents are cinnamo-benzylic æther and resin, and its action resembles that of the turpentines. It is highly spoken of as a remedy for chronic vesical catarrh, and it is used externally as a fumigation in rheumatic affections, and as an ingredient in various ointments; lately it has been used in scabies [1 pt.: 2 pts. lard]. *Dose* internally, ♏x.—xv. or xxx., suspended in mucilage.

Much "Vanilla chocolate" owes its aroma merely to Balsam of Peru.

Balsamum Tolutanum, *Balsam of Tolu*, which is derived from Myroxylon Toluiferum, one of the South American Papilionaceæ, has similar properties to the above. It is a dry resinous mass, which is soluble in alcohol, and contains the pure hydrocarbon, toluol, in company with cinnamic acid, &c. It is sometimes recommended in doses of from 0·1—1·0 as a remedy in nocturnal incontinence of urine.

Preparations:—

(1.) *Syrupus Tolutanus.* (Balsam of tolu, sugar, water; 1 in 29 nearly, B.P.; 1 in 18, U.S., made with tincture of tolu). *Dose*, ʒ j.—ij.

(2.) *Tinctura Tolutana* (1 in 8, B.P.; 1 in 10, U.S.). *Dose*, ♏ xv.—xxx. [These preparations are popularly supposed to have expectorant properties.]

Styrax Præparatus.

Storax. A balsam having an aromatic smell, which is prepared from the bark of Liquidamber Orientale by heat and pressure. It contains styrol, styracin ($C_{18}H_{16}O_2$), styracic acid, benzoic acid, and resin (*Metastyrol*). It was formerly used as a dressing to atonic ulcers, and it is now used as a tolerably pleasant and efficient parasiticide in scabies, and pediculi pubis. A good way of using it, is to mix equal parts of styrax and olive oil. It is to be rubbed in twice a day. In

Germany, it has almost superseded all other methods of treating scabies. In children, and in persons with delicate skins, it readily causes an eczematous irritation. In such cases, it must be used more diluted (1 to 3 of olive oil).

Balsamum Copaibæ.

Copaiva. Obtained by incising the bark of Copaifera Multijuga, a South American tree. It contains more than 40 per cent. of an æthereal oil, and more than 50 per cent. of resin.

Action.—Both locally and generally similar to that of turpentine. If much of it be taken, it sometimes induces an erythematous [and pseudo-inflammatory] condition of the skin [which speedily subsides if it be discontinued].

The resinous acid to which its local effects are due, passes into the urine and can be precipitated from it in a gelatinous form by stronger acids. It imparts a peculiar odour to the urine.

Use.—It is especially valuable in catarrh of the urinary organs; it is also said to subdue the hyperæsthesia of the bladder, which may succeed severe vesical catarrhs. *Dose,* ¼—½ a teaspoonful several times a day, or the same quantity made into pills with wax, or as an emulsion with liquor potassæ, or alone in gelatine capsules.

[Copaiva Resin has been strongly recommended in ♏x. doses *ter die,* as a diuretic in hepatic ascites and cardiac dropsy (Wilks)].

Preparations :—

(1.) *Oleum Copaibæ,* B.P., U.S. (Distilled from the resin.) *Dose,* ♏v.—xxx.

(2.) *Pilulæ Copaibæ,* U.S. (Copaiva, 16 pts., magnesia, 1 pt.) *Dose,* gr. v.—xxx.

Cubebæ.

Cubebs. The dried fruit of Piper Cubeba, or *Cubeba Officinalis* (Piperaceæ), from Java. Owing to the fruit-stalk which adheres to them, they are also called *Piper Caudatum.* They contain an æthereal oil, a crystalline body of no special properties, called Cubebin, and an amorphous resinoid acid which appears to be their active principle. It passes into the urine, and probably cures gonorrhœa by being thus brought into immediate contact with the affected parts. If incautiously used, it is liable to excite severe irritation of the kidneys. Cubebs are given in the form of powder, in doses of 1·0—3·0 several times a day, or as one of the following preparations :—

(1.) *Oleum Cubebæ,* B.P., U.S. (Distilled from the fruit.) *Dose,* ♏ v.—xx.

(2.) *Tinctura Cubebæ* (1 in 8, B.P., U.S.). *Dose,* ʒ ss.—ij.

The U.S. Pharm. has also—

(3.) *Oleoresina Cubebæ.* (An æthereal extract.) *Dose* ♏ v.—xxx.

(4.) *Extractum Cubebæ Fluidum* (1 in 1). *Dose,* ʒ ss.—ij.

(5.) *Trochisci Cubebæ.* (Containing gr. ss. of oleoresin in each.) *Dose,* 1—3.

The following drugs are nearly obsolete :—

Serpentariæ Radix, Virginia snake-root. The rhizome of Aristolochia Serpentaria (Aristolochiaceæ). It contains an acrid extractive body in addition to the æthereal oil. Its action is identical with that of many other medicines of the same kind. *Dose* of the powdered root, gr. x.—xv.

Preparations :—

(1.) *Infusum Serpentariæ* (1 in 40, B.P.; 1 in 32, U.S.). *Dose,* ℥ ss.—ij.

(2.) *Tinctura Serpentariæ* (1 in 8, B.P.; 1 in 7½, U.S.). *Dose,* ʒ ss.—ij.

(3.) *Extractum Serpentariæ Fluidum*, U.S. (1 in 1). *Dose*, ʒ ss.—ij.

Pyrethri Radix. B.P., Pellitory root. From Anacyclus Officinarum, growing in the Levant and also cultivated in Germany. It has been recommended in lingual paralysis, toothache, and also as a diaphoretic, &c. It has a burning taste.

Preparation:—

Tinctura Pyrethri (1 in 5). As a mouth wash.

The powered flowers of Pyrethrum Roseum and P. Carneum, natives of the south-east Caucasus, are known in commerce as "Persian Insect Powder." The latter is often adulterated. The genuine powder retains its efficacy for years.

[**Piper Nigrum**, the unripe berries of the *Black pepper*, from the East Indies (Piperaceæ). Its active principle is Piperin ($C_{17}H_{19}NO_3$), but it also contains æthereal oil and resin. It stimulates those mucous membranes to which it finds local access. Hence, besides its use as a spice, it is given to affect the rectum in piles, and less frequently the urethra in gonorrhœa.

Preparations:—

(1.) *Confectio Piperis*, B.P. (Pepper, 2 pts., caraway seeds 3, honey 15; 1 in 10.) *Dose*, ʒ j.—ij.

(2.) *Oleoresina Piperis*, U.S. (An æthereal extract.) *Dose*, ♏j—ij.)]

Flores Chamomillæ Vulgaris, PHARM. GERM., U.S.

German Chamomile flowers. Derived from Matricaria Chamomillæ, a well-known composite. The oil contained in the flowers is said to be anti-spasmodic. They are chiefly used in neurotic pains, whether situated immediately in the female sexual organs, or due to irritation reflected from them to other parts. They are also given to increase the menstrual flow. *Dose* of the powdered flowers, ʒ ss.—j.; of the æthereal oil (a dark blue, very expensive liquid), ♏ij.—iv.

Flores Chamomillæ Romanæ.

Roman Chamomile flowers. Derived from Anthemis nobilis, officinal in England under the title of *Anthemidis Flores.* Their action is similar to that of the above, and they are also said to act as an aromatic bitter stomachic tonic.

[The Oleum Anth. is useful as an addition to sulphur ointment (♏x. ad ℥j.) to disguise its smell.]

Preparations:—

(1.) *Extractum Anthemidis,* B.P. *Dose,* gr. ij.—x.

(2.) *Infusum Anth.* (1 in 20, B.P.; 1 in 32, U.S.). *Dose,* ℥j.—iij.

(3.) *Oleum Anthemidis,* B.P. (Distilled from the flowers). *Dose,* ♏ij.—iv.

Flores Arnicæ, *Arnica.* Derived from Arnica Montana, a sub-Alpine composite. The flowers contain an æthereal oil, and an amorphous bitter principle, *Arnicin,* and have been especially recommended in the treatment of paralyses dependent on cerebral and spinal apoplexies. They are given as an infusion of 10—20 grammes in 150·0 water, the dose being a table-spoonful every two or three hours. In Germany, the *Tinctura Arnicæ* is prepared from them; it is especially used as a discutient. Arnica is a much more irritating preparation than has been usually supposed [and severe eczematous eruptions have followed its application to bruises]. The alcoholic extract of the blossoms, if treated with chloroform, appears, after the evaporation of the latter, as a greenish yellow mass which irritates the healthy skin so as even to blister it (Wilms), hence there have been many cases of poisoning after taking the tincture internally. In one case, 60—80 grammes, which were inadvertently swallowed at one dose, caused the death of a healthy man in thirty-eight hours. The *post-mortem* examination only revealed inflammation and patches of ulceration in the intestines (Wilms). The root alone is used in Great Britain for the preparation of the tincture, whereas in the U.S. Pharm. only the flowers are officinal.

Preparations:—

(1.) *Tinctura Arnicæ* (1 in 20, B.P.; 1 in 5, U.S.). *Dose*, ʒ j.—ij., B.P.; ♏x.—xxx., U.S.

(2.) *Extractum Arnicæ*, U.S. (An alcoholic extract.) *Dose*, gr. v.—x.

(3.) *Emplastrum Arnicæ*, U.S. (Extract of arnica flowers, ℥ iss., resin plaster, ℥ iij., melted together.)

Radix Artemisiæ, Pharm. Germ. The root of Artemisia Vulgaris (Compositæ). Besides the oil, it contains a quantity of an acrid aromatic resin. The powdered root has been long used in epilepsy, and, in fact, it appears to deserve its reputation in cases occurring in women with disturbance of the generative function, and in whom no other cause for it can be discovered (Burdach, Nothnagel). Nothing whatever is known as yet as to the *rationale* of its action. The dose is from 1·0—4·0 of the powder suspended in some warm liquid.

Crocus, *Saffron*. From Crocus Sativus, one of the Irideæ. The *stigmata* are dried and used in medicine. They contain a yellowish substance with a bitter taste and an aromatic smell, from which a quantity of æthereal oil can be extracted. Saffron is used as a colouring material, and also, like chamomile, as a remedy in scanty and painful menstruation. The *dose* is 0·5—1·0 in powder, pill, or infusion. In animals, the injection of a strong infusion of saffron into the veins produced a rise of temperature of some duration, accompanied by a moderate degree of stupefaction. *Crocin* is the name given to the isolated colouring matter of saffron.

Preparation:—

Tinctura Croci, B.P. (1 in 20.) *Dose*, ʒ ss.—ij., chiefly used as a colouring agent.

Rhizoma Iridis, *Orris root,* Pharm. Germ. Is derived from one of the Italian Irideæ, and is frequently used in Germany as an addition to expectorant medicines, owing to the sweet scented oil which it contains. The powdered root is used as an agreeable coating for pills. There is no objection to the use of the entire root by infants, when cutting their teeth.

[Iridin, a crude resin made by precipitating a tincture of the root of *Iris Versicolor*, American blue Flag, with hydrochloric acid, is a very powerful cholagogue, and stimulant of the intestinal secretion, but less active than Podophyllin (Rutherford and Vignal.)*]

Flores Sambuci.

Elder flowers. Derived from Sambucus Nigra (Caprifoliaceæ). They are said to be a good diaphoretic, and are frequently administered in the form of tea. There is a *Succus Sambuci Inspissatus*, officinal in Germany, which consists of the juice of the berries evaporated down and mixed with sugar. It is added in the proportion of 20·0 : 150·0 to diaphoretic mixtures. The æthereal oil is seldom extracted from the flowers, but it is contained in Aqua Sambuci, B.P., and Pharm. Germ.

Preparations:—

Aqua Sambuci, B.P. (1 in 1). *Dose*, ℥j.—ij., but chiefly used as a wash for the skin.

Flores Tiliæ, *Lime blossoms.* From Tilia ulmifolia and Platyphyllos (Tiliaceæ). An æthereal oil with a pleasant odour and soluble to a large extent in water, can be prepared from them (Winckler). It is much used in Germany as a diaphoretic in the form of tea.

[* All the results in this work to which the names of Rutherford and Vignal are appended refer to experiments on the dog.]

Folia Menthæ Piperitæ.

Peppermint leaves. From Mentha Piperita, a Labiate cultivated in Europe. An essential oil, *Oleum Menthæ Piperitæ*, is distilled from it. When taken into the mouth it has at first a burning taste, which is followed by a sensation of coldness during which the mucous membrane becomes temporarily anæmic.

Preparations :—

(1.) *Aqua Menthæ Piperitæ.* (Prepared by distilling the oil with water.) *Dose,* ℥j.—ij.

(2.) *Essentia Menthæ Pip.*, B.P. (1 in 5). *Dose,* ♏x.—xx.

(3.) *Spiritus Menthæ Pip.* (1 in 50, B.P.; 1 in 16, U.S.) *Dose,* ♏xxx.—lx.

(4.) *Trochisci Menthæ Pip.*, U.S. (Oil of peppermint, sugar, mucilage of tragacanth ; ♏⅛ oil in each.) *Dose,* 1—5 lozenges.

Menthæ Viridis Oleum. *Oil of Spearmint.* Resembles peppermint in its properties. *Dose* ♏j.—iv.

Preparations :—

(1.) *Aqua Menthæ Viridis*, B.P., U.S. *Dose,* ℥j—ij.

(2.) *Spiritus Menthæ Viridis*, U.S. (1 in 16). *Dose,* ♏xxx.—xl.

Folia Rosmarini, *Rosemary leaves.* From Rosmarinus Officinalis, a Labiate cultivated in gardens. The Oleum Rosmarini is distilled from them.

An *Unguentum Rosmarini Compositum*, consisting of oleum rosmarini, oleum juniperi, and oleum myristicæ, melted with wax and lard, is said to be a nerve stimulant when externally applied, and is used in Germany in peripheral paralysis. It is quite conceivable that these irritating oils, as well as the repeated friction, may improve the nutrition of the paralysed parts, and so aid in restoring their activity. *Dose* of *Oleum Rosmarini,* ♏ij.—v.

Preparation:—

Spiritus Rosmarini, B. P. (1 in 50). *Dose*, ♏ xij.—xxx.

Flores Lavandulæ, *Lavender flowers*. From Lavandula Officinalis (Labiatæ). An essential oil is distilled from it—the *Spiritus Lavandulæ*. (Oil of lavender, 1, rectified spirit, 49, B.P., U.S.) *Dose*, ♏xxx.—lx. Besides its use as an antispasmodic and carminative, is used as an external stimulant to paralysed parts. The *dose* of the oil is ♏j.—iv.

Preparation:—

Tinctura Lavandulæ Composita, B.P. (Oil of lavender, oil of rosemary, cinnamon, nutmeg, red sandal wood, rectified spirit.) *Dose*, ʒ ss.—ij.

Spiritus Lavandulæ Compositus, U.S., only differs from the former in containing cloves. *Dose*, ♏xxx.—lx. [A stimulant and carminative, also used as a colouring material.]

Macis, PHARM. GERM., U.S.

Mace blossoms. The arillus of the fruit of Myristica Officinalis and Fragrans, East Indian trees (Myristiceæ). The Oleum Myristicæ rubbed up with sugar, or the *Spiritus Myr*, can be added to medicines intended to stimulate gastric digestion. [The British Pharmacopœia only uses the nutmeg (*Myristica*), the kernel of the seed, for preparing the oil by distillation.] *Dose* of the oil, ♏ij.—vj.

Preparation:—

Spiritus Myristicæ (1 in 50, B.P.; 1 in 49, U.S.). *Dose*, ♏xxx.—lx., B.P.; ʒj.—ij., U.S.

[Powdered nutmeg is used in several preparations to cover the nauseous taste of other drugs.]

Cortex Fructus Aurantii, Orange rind. The outer layer of the rind of Citrus Vulgaris, and C. Bigaradia (Aurantiaceæ). The parenchyma contains a bitter principle, while the æthereal oil is secreted by the numerous small glands which lie close under the epidermis.

Preparations :—

(1.) *Infusum Aurantii*, B.P. (1 in 20). *Dose*, ℥ j.—ij.

(2.) *Infusum Aurantii Compositum*, B.P. (Bitter orange peel, lemon peel, cloves, boiling water; 1 in 40.) *Dose*, ℥ j. —ij.

(3.) *Syrupus Aurantii*, B.P. (Tincture of orange peel, 1 pt., syrup, 7 pts.) *Dose*, ʒ j.—ij. *Syrupus Aurantii Corticis*, U. S. (Sweet orange peel, sugar, alcohol, water.) *Dose*, ʒ j. and upwards.

(4.) *Tinctura Aurantii* (1 in 10, B. P.; 1 in 8, U.S.). *Dose*, ʒ j.—ij.

(5.) *Tinctura Aurantii Recentis*, B.P. *Dose*, ʒ j.—ij.

(6.) *Vinum Aurantii*, B.P. Orange wine, a vehicle for quinia, cod-liver oil, &c.

The Pharmacopœia also contains the following preparations of the lemon (Citrus Limonûm) :—

(1.) *Oleum Limonis*. (Distilled from fresh lemon peel.) *Dose*, ♏ j.—iv.

(2.) *Syrupus Limonis*. *Dose*, ʒ j.—ij.

(3.) *Tinctura Limonis*, B.P. (1 in 8). *Dose*, ʒ ss.—ij.

(4.) *Limonis Succus* (Lemon juice). *Dose*, *ad libitum*.

The *Aurantii Flores*, orange flowers, are also officinal as *Aqua Aurantii Florûm*, B.P., U.S. (Fresh orange flowers, ℥ xlviij., water, Oxvj.; Oviij. to be distilled over by means of steam. (*Dose*, ℥ ss—j.

Preparation :—

Syrupus Aurantii Florûm. Orange flower water, 8 pts., sugar, 48 pts., water, 16 pts. heated and strained, B.P.; orange flower water, ℥ xx., sugar, ℥ xxxvj., U.S.) *Dose*, ʒ j. —ij. Both these drugs are chiefly used to flavour other medicines.

Fructus Cardamomi. The capsules and seeds of Elettaria Cardamomum, from Malabar (Scitamineæ). ***Cardamoms***

are chiefly used in the form of *Tinctura Cardamomi Composita*, B.P. (Cardamom seeds, caraway, cinnamon, cochineal, raisins, proof spirit; 1 in 80.) *Dose*, ʒ ss.—ij.

The U.S. Pharm. has a *Tinctura Cardamomi* (1 in 8). *Dose*, ʒ j.—ij.; and a *Tinct. Card. Co.* containing honey instead of raisins; strength, 1 in 50). *Dose*, ʒ j.—ij.

Rhizoma Zingiberis, *Ginger root.* From Zingiber Officinale, one of the tropical Scitamineæ. [A popular remedy in flatulent dyspepsia.]

Preparations:—

(1.) *Syrupus Zingiberis.* (Tinctura Zingiberis Fortior, 1 pt., syrup, 25 pts., B.P.; made with fluid extract, sugar, and water, U.S.) *Dose*, ʒ j.—iv.

(2.) *Tinctura Zingiberis* (1 in 8, B.P.; 1 in 3¾, U.S.) *Dose*, x.—xxx.

(3.) *Tinctura Zingiberis Fortior*, B.P. (1 in 2). *Dose*, ♏ v.—xx.

The U.S. Pharm. also has an *Extractum Zing. Fluidum* (1 in 1), *dose*, ♏ x.—xxx., and an *Oleoresina Zingiberis* (an æthereal extract), *dose*, ♏ j., much diluted.

Fructus Vanillæ, *Vanille.* From Vanilla Planifolia, a Mexican Orchid. The skin of the fruit contains the crystalline *Vanillin* ($C_8H_8O_3$), vanilla camphor, or vanillic acid, on which its pleasant smell and taste depend. A *Tinctura Vanillæ* (Pharm. Germ.) is given internally in doses of 30 to 60 minims, and is used externally as an ingredient in mouth washes and tooth tinctures. *Vanilla Saccharata*, 1 pt. of the finely powdered fruit to 9 pts. of sugar, may be used as an addition to powders or for coating pills. Vanille has been said to have a specially stimulating action on the sexual organs; and if a *direct* aphrodisiac were ever indicated, this would probably be the most harmless.

Vanille sometimes excites severe choleraic diarrhœa, but it is unknown to what poisonous constituent this effect is due. Vanille is now artificially prepared from Coniferin ($C_{16}H_{22}O_8$), which is a glucoside present in the juice which exists in the cambium of certain pines. The process of extraction consists in boiling it with dilute acids, or acting on it with emulsin, when it is decomposed with absorption of water.

One or two æthereal oils, the products of coniferous trees, require special consideration.

Terebinthina.

Ordinary Turpentine. A balsam obtained from different species of pine. That from Larix Decidua is officinal in Germany, as *Terebinthina Laricina*, or Venice Turpentine. They are both solutions of resin (Abietic acid) in an æthereal oil, and exude from the fir-bark naturally as well as through artificial incisions. The ordinary turpentine is only used externally in plasters, &c. The Venice turpentine is thinner, clearer, and more aromatic.

An *Oleum Terebinthinæ Rectificatum* is prepared by distilling turpentine with water, and rectifying with steam. That used in Great Britain is distilled from the turpentine of Pinus Palustris and P. Tæda.

Resina Pini, *Pix Burgundica.* Prepared by melting the resin of the spruce fir *Abies Excelsa*, with repeated addition of water, and straining. It is resin mixed with water and some æthereal oil. The residue after distilling off the Oleum Terebinthinæ, when carefully melted down until all water has been driven off, forms the ordinary Colophonium or *rosin*, which is used in preparing plasters, &c.

Oil of turpentine has an irritant *action* on animal tissues, and therefore in large doses, or if repeatedly applied, excites inflammation of the stomach and intestines, and eczema on the external skin. The oil is not completely oxidised in the blood and tissues, for it can be detected in the breath and the urine by its aromatic odour, which resembles that of violets, and is well marked even after small doses (1—2 drops). Abietinate of soda is also excreted in the urine (Maly) Turpentine may cause sufficient irritation of the kidneys to produce hæmaturia. The physiological properties of oil of turpentine have not undergone any further special investigation.

If oil of turpentine is allowed to remain exposed to the air, and to the action of light in a bottle which is only partly filled with it, the cork becomes bleached. This is due to the action of ozone (O_3), or the nascent oxygen derived from it (O_1), and which is formed in all cases of slow combustion and especially of that of oil of turpentine. Part of the nascent oxygen remains dissolved in the turpentine in company with carbonic acid, formic acid, acetic acid, and a number of oxidised compounds, which continue to form until the oil is completely converted into resin.

Use.—Oil of turpentine has been recommended in a vast number of different diseases, *e.g.*, in paralyses, sciatica, dropsy, gallstones, to destroy tape worm, &c. It has found the greatest favour in the treatment of sciatica, although we cannot at present give any rational explanation of its action. It is valuable in bronchial catarrh, and diminishes the pulmonary irritation and expectoration. In hæmoptysis it may be given in 15 minim doses every three hours (Oppolzer). It has also been much recommended in chronic vesical catarrh. If the bronchial secretion has an offensive character, this is often removed by oil of turpentine, possibly because the latter is a good carrier of ozone. The oxidisable products of the bronchial mucous membrane are burnt up quicker, and cannot undergo decomposition as they did before contact with the nascent oxygen; or else the development of fungi in the lungs (*Lungenmykose* of Leyden and Jaffe), on which their fœtid character partly depends, is arrested. The sedative action of the hydrocarbon as such, is also, as far as we know anything of the æthereal oils, concerned in producing this effect.

(The authors we have just mentioned have stated that inhalations of pure oxygen exert a beneficial action on fœtid bronchitis, and the conclusion which they draw—that the same gas would have a still better effect if it were mixed with a quantity of ozone, so small as not to irritate the larynx—is also theoretically admissible. It is true that physiological experiments are needed to confirm or support the results obtained in the ozone treatment of bronchitis, and still more of other affections, such results being generally so liable to mislead.)

Skoda recommends oil of turpentine in gangrene of the lungs. Acute inflammation of the middle ear (Weber-Liel) has been also successfully treated with the oil, and if sufficiently large doses be used, all the symptoms of this painful affection are said to be at once alleviated.

If phosphorus be moistened with oxidised oil of turpentine it loses the property of shining in the dark. Owing to this fact, and to the good results which are said to have followed its administration, it has been recommended (chiefly by French physicians, as an antidote to that poison. The dose of the *oxidised* oil would be 1·0 given by the mouth as soon as possible after the phosphorus had been taken, and repeated several times. The active oxygen it contains ought, theoretically, to convert the latter into the relatively harmless phosphoric acid.

Dose, 5—30 drops, either in capsules or made into an emulsion with gum water. In bronchial catarrh it is best given as an *inhalation*, 5—10 drops being sprinkled on a handkerchief several times a day, and the vapour inspired as deeply as possible. [The oil may also be conveniently inhaled from the surface of hot water.] Even in this form it is said that it sometimes causes excessive irritation of the kidneys. As a fact, the inhalation of a single drop of the oil imparts an odour of violets to the urine.

The external application of turpentine and of the oil as a stimulant to the skin may be made use of in various ways. Thus, *inter alia*, it has been employed successfully [in *alopecia areata* (D. Duckworth)] in parasitic skin diseases, and in traumatic erysipelas (Lücke). It is contained in the following liniments and ointment:—

(1.) *Linimentum Terebinthinæ.* (Oil of turpentine, 16 pts., camphor, 1 pt., soft soap, 2 pts., B.P.; resin cerate, ℥xij., oil of turpentine, Oss., U.S.)

(2.) *Lin. Terebinthinæ Aceticum*, B.P. (Oil of turpentine, acetic acid, camphor liniment, equal parts.)

(3.) *Unguentum Terebinthinæ*, B.P. (Oil of turpentine, resin, yellow wax, prepared lard; 1 in 2⅛.)

There can be very little doubt that part of its benefit, especially in diseases of the lungs, is due to the continual impregnation of the air which the patient breathes with turpentine; but, on the other hand, we must remember that like most volatile substances the oil enters the circulation through the skin. In some parts of Germany baths made with an infusion of the fresh needles of certain pines, with or without the addition of some of the pine oils, are largely used. It is quite certain that they can accelerate tissue change by powerfully stimulating the skin; hence their action resembles that of brine or sea baths, or cold water treatment.

Preparations:—

(*a.*) Of Pix Burgundica—

Emplastrum Picis. (Burgundy pitch, frankincense, resin, yellow wax, expressed oil of nutmegs, olive oil, water, B.P.; Burgundy pitch, 72 pts., yellow wax, 6 pts., U.S.)

(*b.*) Of Oil of Turpentine—

(1.) *Confectio Terebinthinæ*, B.P. (Oil of turpentine, liquorice, honey; 1 in 4.) *Dose*, ʒj—ij.

(2.) *Enema Terebinthinæ*, B.P. (Oil of turpentine, ℥j., mucilage of starch, ℥xv.). For one enema.

The U.S. Pharm. also orders *Pix canadensis*, hemlock pitch (*Abies Canadensis*) in the form of *Emplastrum Picis Can.* (Canada pitch, 72 pts., yellow wax, 6 pts.)

[The following drugs which are not included in the German Pharmacopœia, but which are allied to the above, may be inserted here:—

(1.) **Larix Europœa.** Larch bark, used in the form of the following preparation in bronchitis, with profuse expectoration:—*Tinctura Laricis*, B.P. (1 in 8.) *Dose*, ℳxx.—xxx.

(2.) **Thus Americanum,** Common Frankincense. An exudation from the bark of *Pinus tæda.* It is an ingredient in Emplastrum Picis, B.P.]

Fructus Juniperi.

Juniper berries. Derived from Juniperus Communis (Coniferæ), common juniper. The chief constituent of the berries is an æthereal oil which is officinal as *Oleum Juniperi.* Its *dose* is 1—6 minims. The *Spiritus Juniperi*, B.P., is a mixture of 1 pt. of the oil, with 49 pts. of rectified spirits. *Dose*, ℳxxx.—lx. The *Spiritus Juniperi*, Pharm. Germ., is made by macerating the berries with alcohol and water, and distilling. It is chiefly used as a discutient embrocation. The *Succus Juniperi Inspissatus*, *Roob Juniperi*, Pharm. Germ., is a brown semi-liquid mass which is added to diuretic mixtures in the proportion of 20·0—50·0 to 150·0. [According to some authorities (Vogel), juniper is a powerful diuretic.]

The U.S Pharmacopœia has

(1.) *Spiritus Juniperi* (1 in 60.) *Dose*, ℳxx.—lx.

(2.) *Sp. Juniperi Compositus.* (Oil of juniper, oil of caraway, oil of fennel, alcohol, water: strength, ʒ iss. oil of juniper in Oviij.) *Dose*, ʒ ij.—iv.

(3.) *Infusum Juniperi* (1 to 16). *Dose*, ℥ ss.—ij.

Sabinæ Cacumina.

Savin tops. The fresh and dried tops of Juniperus Sabina, one of the Coniferæ. The tops contain the officinal æthereal oil of savin, an irritant which if taken in sufficient quantity causes gastric pain, vomiting, diarrhœa, hæmaturia, and spasm of the bladder. The pelvic organs are said to be severely irritated by it, and rendered hyperæmic. For this reason, savin has been much recommended and used as an emmenagogue and abortifacient medicine, and if given when there are proper indications for it, and in conjunction with other measures, it really appears to have some value. The tops may be prescribed in powder, pill, or infusion, in doses of 0·3—1·0 several times a day, but it is better to use either the oil in doses of 1—5 minims, or the tincture, B.P., in doses of 15—30 minims. In the form of *Unguentum Sabinæ*, Pharm. Germ., B.P., they are used to slowly destroy condylomata, and also to keep open blisters. The U.S. Pharm. has an *Extractum Sabinæ Fluidum* (alcoholic extract). *Dose*, ♏v.—xv.

Folia Rutæ, *Rue leaves.* Derived from Ruta Graveolens (Rutaceæ), are also reputed to act as an emmenagogue. They cause redness of the skin if locally applied. The crystalline body called Rutin, seems to have no special action. [The only preparation (B.P. and U.S.) is Oleum Rutæ. *Dose*, ♏ij.—vj.]

Oleum Rosarum, *Oil of Roses.* Is used to impart a pleasant scent to ointments in the proportion of three drops to the ounce.

Oleum Florûm Aurantii, or Neroli Oil, is similarly used, and it is also the principal ingredient in *Aqua Florûm Aurantii*, Orange Flower Water. (*Vide supra*, p. 90.)

Expensive æthereal oils are often adulterated, chiefly with fats, alcohol, or oil of turpentine.

Most of the above-mentioned oils can be administered con-

veniently on sugar in the form of *Elæosacchara*, one drop of the oil with 2·0 white sugar.

Oleum Petræ Italicum, Pharm. Germ., *Crude Petroleum.* Is a mixture of hydro-carbons, chiefly belonging to the fatty series, and homologous with marsh gas. The solid compounds are dissolved in the liquid ones. Petroleum occurs in certain geological strata, and appears to be a product of vegetable decomposition. It can only be taken up into its constituent compounds with difficulty by fractional distillation. Those which first pass over, as high as caprylene (C_6H_{14}), form Petroleum Æther.

Æther Petrolei, PHARM. GERM.

A colourless, very volatile, and inflammable liquid. Both it and the crude oil are used as liniments in rheumatism, sluggish inflammations, *e.g.*, chilblains, &c., the crude oil being, however, almost entirely restricted to veterinary purposes. It is certain that petroleum æther, like so many other volatile hydrocarbons, has a local sedative effect if vigorously rubbed into the skin, but the effect does not last long. The German Pharmacopœia orders it to be distilled from American petroleum or rock oil, from which benzine (*vide infra*) is also derived. The æther has a much lower boiling point than the benzine, and is dangerously inflammable.

Among the group we are now considering, the gum resins occupy a peculiar position, owing partly to their physical properties, and partly to the special indications for their use.

Assafœtida.

The gum resin of Narthex Assafœtida, one of the Umbelliferæ growing in Persia, on the banks of the Indus, and elsewhere. The gum resin is obtained by making incisions in the root. Its æthereal oil has a disagreeable smell, and is probably identical in the main with *sulphide of allyl*, derived from Allium Sativum, common garlic. This drug was formerly reputed a sovereign remedy in hysterical convulsions, as well as in various other spasmodic actions; but since we have learnt to refer the greater part of the so-called hysterical symptoms to pathological changes in the female sexual organs, *e.g.*, hyperæmia, flexions, ulcerations, catarrh, ovaritis, &c., and to treat these conditions as such, assafœtida is much less prescribed by gynæcologists than it formerly was. Owing to its harmlessness, and to the reputation it has acquired among medical men, and further because it is certain that combinations like those of sulphide of allyl have a depressing action on the nervous tissues, it is still advisable to give it as an enema in suitable cases. Five or six grammes are rubbed up with white of egg, amalgamated with 100·0 water, and injected high up into the bowel in two portions.

Preparations:—

(1.) *Tinctura Assafœtidæ* (1 in 8, B.P., U.S.) *Dose*, ʒ ss.—j.

(2.) *Spiritus Ammoniæ Fœtidus*, B.P. (Assafœtida, strong solution of ammonia, rectified spirit; 1 in 10.) *Dose*, ʒ ss.—j.

(3.) *Enema. Assaf.* B.P. (Assafœtida, gr. xxx., water, ℥ iv.) For one enema.

(4.) *Pilula Assaf. Composita*, B.P.; *Pil. Galbani Co.*, U.S. (Assafœtida, galbanum, myrrh, each 2 pts., treacle, 1 pt.) *Dose*, gr. v.—x.

The *Pilulæ Assafœtidæ*, U.S., contain assafœtida, gr. lxxij., soap, gr. xxiv., divided into twenty-four pills. *Dose*, gr. iv.—xij.

(5.) *Pilula Aloes et Assafœtidæ. Vide* Aloes.

The U.S. Pharm. also has *Emplastrum Assafœtidæ* (lead plaster, galbanum, yellow wax, alcohol, and assafœtida); *Mistura Assafœtidæ* (gr. cxx. to water, ℥ viij.). *Dose*, ℥ ij.—iv. as an enema; by the mouth, ℥ ss.—ij.; and *Suppositoria Assafœtidæ* (tincture of assafœtida, f℥j., oil of theobroma, gr. cccxx., melted and divided into 30 grain suppositories).

Allium, Garlic, the bulb of Allium Sativum is officinal, U.S., and used empirically as a stimulant, expectorant, and emmenagogue.

Preparation:—

Syrupus Allii. (Garlic, ℥ vj., sugar, ℥ xxiv., diluted acetic acid, Oj.) *Dose*, ʒ j.

Galbanum. Derived from Ferula erubescens, one of the Persian Umbelliferæ. The gum resin exudes from the stalks, and is afterwards artificially purified. It forms greenish and yellowish-brown lumps, containing an æthereal oil, whose main constituent is isomeric with camphor. A special action on the female generative organs (as yet scientifically undefined), has been ascribed to it, and it has been much prescribed in amenorrhœa. *Dose*, 0·2—1·0 gr. in pills or emulsion.

The *Emplastrum Galbani*, B.P. (Wax, ammoniacum, galbanum, and emplastrum plumbi; 1 in 11), and the *Emplastrum Galbani Co.*, U.S. (Galbanum, turpentine, Burgundy pitch, lead plaster; 1 in 6), are local stimulants.

Galbanum is contained in *Pil. Assafœtidæ Co.*

Ammoniacum. Derived from Dorema Ammoniacum, a Persian Umbellifer. It forms yellowish-brown granules, which becomes soft on heating. They contain, *inter alia*, a sulphurless æthereal oil (Buchheim). The indications for the use of this drug are also very indefinite. It is given in pills or emulsion in doses of 0·2—1·0.

[It is popularly supposed to be a stimulant and expectorant. It is contained in *Pilula Scillæ Composita.*

The *Emplastrum Ammoniaci*, U.S. (Ammonia, diluted acetic acid) and *Empl. Ammon. c. Hydrargyro*, B.P., U.S., are supposed to be "resolvent."

Preparation :—

Mistura Ammoniaci. (ʒ ij. to ℥ viij. water, B.P., U.S.) *Dose*, ℥ ss.—j.]

Myrrha.

Myrrh. From Balsamodendron Myrrha, an Arabian plant (Burseraceæ). The gum resin consists of reddish brown, shining pieces of a bitter taste and aromatic smell, and containing about two per cent. of æthereal oil. It is reputed to be a stimulant which acts like a spice on the digestive organs and the heart, increasing the secretion of the mucous membranes, and improving the general nutrition (Schroff). From experiment we know that myrrh even in the dose of thirty minims of the tincture (Pharm. Germ.) increases the number of white blood corpuscles on the average four-fold, and we know from counter experiments that this result is not due to the alcohol (Hirt). This points to an increased activity of the blood-forming glands induced by the myrrh, and may help to explain its empirical use in chlorotic conditions, which was formerly much greater than it is at present. *Dose* of the gum resin, gr. iij.—xxx.; of the *Tincture*, ♏x.— ʒ j.

The latter is still much used as a mouth wash [or gargle], as well as in relaxed and ulcerated conditions of other mucous membranes. (Strength of the tincture, 1 in 8, B.P.; 1 in 10, U.S.)

[**Armoraciæ Radix,** B.P., *Horse-radish Root.* Obtained from Cochlearia Armoracia (Cruciferæ), cultivated in Europe. The root contains a pungent volatile æthereal oil (C_3H_5,CNS), sulphocyanide of allyl, similar to that which forms in black mustard seeds, and which is present in scurvy grass and other allied plants of the order of Cruciferæ.

Use.—The scraped root is eaten with beef and other meats to stimulate appetite, and in the form of the compound spirit it has been given for the same purpose in atonic dyspepsia. Diuretic properties have been assigned to it, but the drug has not been scientifically investigated. It is not unlikely that it excites thirst, and so causes an increased quantity of liquid to be drunk. Its reputed effect in aphonia is perhaps explicable on the supposition that it stimulates and braces the larynx indirectly by its contact with the pharynx. Dose of the scraped root, gr. xx.—lx.

Preparation :—

Spiritus Armoraciæ Compositus. (Fresh horse-radish root, dried orange peel, nutmeg, proof spirit, water; 1 in 8.) *Dose,* ʒj.—iij.]

The following drugs from the animal kingdom find their appropriate place here.

Moschus.

Musk. From Moschus Moschiferus, a ruminant resembling a goat, from Eastern Asia. The male has a bag near the penis, which is connected by a duct with the inner surface of the prepuce. This bag contains several grammes of a fatty-looking, albuminous secretion, which has a powerful smell. It is taken out, purified, and then sent into the market enclosed in the original bag. Only Chinese or Thibetan musk is officinal.

Its æthereal constituent has not as yet been isolated. It is soluble in alcohol and water, and has a stimulant action on the motor nerves of the frog and on the heart of warm-blooded animals (Filehne).

Use.—(1.) Many persons regard it as a powerful stimulant when collapse is impending in febrile diseases, such as typhoid fever, pneumonia, exanthemata, &c., and by its means it is said that the strength may be maintained until the histological conditions of the disease take a favourable turn. (2.) In spasmodic conditions of various organs musk has a great, and as it appears, a well-founded reputation in the laryngeal spasm of infants, known as *Laryngismus Stridulus.*

In all cases we should avoid giving musk *too late*, or in insufficient doses.

Dose.—For children under one year about 0·015—0·050 several times a-day; for adults, 0·2—0·5. It can be given as a powder mixed with sugar, and should be prescribed *in chartâ ceratâ* to avoid loss of its volatile principles and absorption of the fat and æthereal oil by the paper. Sometimes it may be better to give rather more than the ordinary dose as an enema. The only objection to this latter plan is its greater expense.

Castoreum, *Castor.* The secretion contained between the numerous præputial folds of the penis and clitoris of the beaver. It forms a brownish, fatty, readily pulverable mass. A distinction is made between *Castoreum Sibiricum*, or Russian, and *Castoreum Canadense*, or English castor, the price of the former being about 50 times that of the latter. It is much used in Germany in hysterical convulsions, paralyses, &c. The best form in which to give it is that of the *tincture* of either variety (1 in 20, B.P.; 1 in 16, U.S.). *Dose,* ʒ ss.—j.

CHAPTER IV.

EMOLLIENTIA.

DEMULCENT DRUGS.

THE drugs contained in this group, which was formerly a very large one, can be classified under several heads corresponding to differences in their physical properties. To the first belong those seeds from which *true emulsions* can be prepared by powdering them and rubbing them up with water; to the second the *fatty oils* which do not contain any irritant ingredient, and which are used either alone or, more usually, in the form of emulsion; to the third that comparatively large group of plants which either swell up, owing to the *gum or mucilage* which they contain, when macerated or boiled, or from which these substances can be separated as such by similar treatment.

All these bodies when applied in a suitable form to surfaces deprived of their epithelium, can form a protecting coating over them, and so alleviate the very severe irritation which the contact of the secretions and the ingesta often excites in the nerves of the part. There can be scarcely any doubt, either, from the analogy of similar phenomena on the external surface of the body, that tissues which are in a state of inflammatory swelling and rigidity may be rendered distinctly less irritable by the application to them of substances which can soothe and protect them. We can indeed directly observe the effects of disease, and also of medical treatment, in inflammation of such accessible parts as the skin, the pharynx, and the conjunctiva, and are, therefore, justified in assuming that what occurs in them will occur in other similarly constituted tissues. Hence, emollient medicines are often of extreme value in the treatment of inflammation of the digestive, the pulmonary, and the urinary tracts.

The therapeutic action of such drugs on the digestive tract is easily explained. If the mucous membrane is deprived of its epithelium owing to catarrh, the digestive secretions affect it in the same way as severe stimuli continually renewed. Hence, the peristaltic movements are intensified, and are accompanied with pain, and the contents of the bowel are hurried through it in a half-digested state. Now the simple administration of an almond emulsion, or of a decoction of salep, will often completely check these symptoms, nor is it easy to account for such a favourable result in any other way than by supposing that the surface of the mucous membrane becomes coated over with the intimate mixture of emulsin and finely divided oil, or with the decoction of vegetable mucilage.

The same is true, *but only partially so*, of the effect of emollients in affections of the air passages. The great popularity which emulsions and such like remedies enjoy in laryngitis and bronchitis appears unable to withstand a well-directed criticism. In passing from the mouth to the stomach such remedies must reach the upper portions of the larynx in their passage through the pharynx and a certain quantity of them must attach itself to the sides of these parts. In this way they may lessen the subjective feeling of soreness and malaise in this region which generally accompanies laryngeal and bronchial inflammation, and thus temporarily alleviate the inclination to cough. The main portion of the emulsion, however, enters the digestive tract, and can only influence the mucous membrane of the air-passages by absorption into the blood and by reaching the mucous membrane through the circulation. But there are strong objections to such a view. In the first place, most of the substances of which we are here speaking are absorbed by the intestine to a very small extent or not at all, and supposing even an infinitely small amount to be actually absorbed, it is scarcely conceivable, when we consider its chemical composition, that this quantity should reach the nerves and mucous membrane of the air-passages unaltered. The fatty oils are indeed absorbed, but it is almost impossible to believe that after following such a circuitous route they can still retain any local emollient action. Lastly, it is impossible to reconcile with any of the ordinarily accepted laws of animal life such a phenomenon as the production of any appreciable effect by substances ordinarily so inactive when diffused through the blood in a diluted state.

The same is true of the effects of emollients on the urinary organs. Milk of almonds and linseed tea are still used as recognised medicines in all forms of acute inflammation of the kidneys or urinary tract, and they are here also supposed to act as a mechanical covering which protects the mucous membrane from the irritation of the urine.

It is most probable that it is not to the mucilage or the finely divided oil that their good effect is due, but rather to the large quantity of water which is introduced into the system with the emollient, or else to the diminished ingestion of food owing to the patient's impaired appetite.

The number of emollient drugs which the older pharmacopœias contained was very large. The following are still officinal.

Amygdalæ Dulces.

Sweet Almonds. The seeds of Amygdalus Communis, a native of the coasts of the Mediterranean (Amygdalaceæ). Its chief constituents are Emulsin and a fatty oil which is almost pure Trioleïn.

Dose.—Sweet almonds are almost exclusively given in emulsion. 20—30 grammes of almonds are shelled, finely pulverised, and then rubbed up with ten times their weight of water. The *Mistura Amygdalæ*, B.P., U.S., consists of sweet almonds, gum arabic, and sugar, emulsified with water. *Dose*, ℥j.—ij. An emulsion can also be made from the *Oleum Amygdalæ*, the oil expressed from sweet and bitter almonds, which does not " dry " or solidify in the cold. Its dose is ʒij.—iv.

The *Emulsio Oleosa*, Pharm. Germ., consists of oil of sweet almonds, 2 pts., gum arabic, 1 pt., and water, 16 pts.

Preparations :—

(1.) *Pulvis Amygdalæ Compositus*, B.P. (Almonds, sugar, gum arabic.) *Dose*, ʒj.—ij.

(2.) *Mistura Amygdalæ.* (1 in 8, B.P.; 1 in 16, U.S. *Vide supra.*)

(3.) *Syrupus Amygdalæ*, U.S., *Almond Syrup.* (Sweet almonds, ℥xij., bitter almonds, ℥iv., sugar, ℥lxxij., water, Oiij.) *Dose*, ʒss.—ij. and upwards.

The *Oleum Amygdalæ* is given to children by itself in doses of 1—2 teaspoonfuls as a mild aperient. Its effect is probably due to certain products of decomposition which are formed in the bowel. It has also been proposed to inject it subcutaneously as a simple form of nourishment in cases of local obstruction in the *primæ viæ;* the plan is, however, useless, as far as we can learn from experiments on animals. The oil remains unabsorbed for days in the subcutaneous cellular tissue without causing any irritation.

Semen Papaveris, Pharm. Germ., *Maw seed.* Derived from Papaver Somniferum (Papaveraceæ). Its constituents have similar properties to those of sweet almonds, and the oil is used in the same form and dose and in the same class of cases as that of the latter. 0·06 per cent. of morphia have been detected in maw seeds (O. Berg).

The **Flores Rhœados** (*Rhœados Petalæ*), the dried petals of Papaver Rhœas, also find a place here. They do not contain any oil, but only mucilage, and are used in preparing the *Syrupus Rhœados*, B.P. [a colourless ingredient possibly possessing slight anodyne properties. *Dose*, ʒj.—ij.]

Semen Lini.

Linseed. Obtained from Linum Usitatissimum (Linaceæ). Its only advantages over the preceding drugs are its lower price, and the larger quantity of emollient material which it contains. The seeds are used unbruised to form a decoction of about 25—50·0 grammes in a litre of water, which is given internally in acute inflammations of the internal mucous membranes.

The *Infusum Lini*, B.P., *Lini Compositum*, U.S., consists of linseed, 160 grs., liquorice, 60 grs., water, 10 fl. ozs. *Dose, ad libitum.*

Externally, linseed is used in the form of meal (*Lini Farina*) for making poultices, the chief value of which, however, consists in the moist warmth with which they surround the part. The average temperature up to which they can be borne is 50° Cent. (122° Fahr.). In order to prevent rapid cooling, as well as the necessity of frequent changes, the quantity of moist linseed to be spread on rag for a poultice must not be too small, and it should form a layer at least half an inch thick. It is well to cover the whole with some bad conductor of heat, such as flannel or cotton wool, a piece of oiled silk being interposed between them.

The linseed meal which is now officinal differs from simple bruised linseed in having had the greater part of the oil removed by expression; this prevents its becoming quickly rancid on exposure to a moist heat.

Preparation:—

Cataplasma Lini, B.P. (Linseed meal, 8 pts., olive oil, 1 pt., boiling water, 20 pts., gradually mixed).

The *Oleum Lini*, linseed oil, is a favourite remedy in burns of every degree in the form of *Linimentum Calcis*, U.S. (Lime water, f ℥ viij., linseed oil, f ℥ vij.) It protects and soothes the parts to which it is applied.

A solution of nitrate of silver in linseed oil (1·0 : 300·00) is also highly spoken of as an application to burns.

Oleum Lini Sulphuratum, Pharm. Germ., *Balsam of Sulphur*, is a solution of sulphur in linseed oil, prepared with the aid of heat, which is used as an embrocation and a dressing for wounds.

Fructus Cannabis, Semen Cannabis, Pharm. Germ., *Hemp seed.* From Cannabis Sativa, native hemp (Urticaceæ). It has a similar composition to the other seeds. Emulsions of hemp seed have a great reputation in Germany, especially in the acute state of gonorrhœa, but it is questionable whether they are of more use than other emulsions or than an equal quantity of water. They are given in the same form and dose as sweet almonds.

The four seeds just described become rancid on keeping, in which case they have a very unpleasant taste when emulsified, and *upset the stomach and excite diarrhœa, instead of curing it.*

Oleum Olivarum.

Olive Oil. Expressed from Olea Europœa. About two-thirds of it are Olein, and the remainder chiefly Palmitin, with a little Stearin and Butin. In consequence of its cheapness it is sometimes used for making emulsions of oil for internal administration of the strength of about 5·0 oil, with 2·5 of gum arabic to 150·0 water. Such mixtures are called *Emulsiones Spuriæ*, in contradistinction to the *E. Veræ*, or emulsions of seeds. Of course only the best oil—*Ol. Olivæ Provinciale*, must be used for this purpose, and even that is too often rancid. It is the safest plan, therefore, to restrict the use of olive oil to the preparations of liniments and embrocations. [The *Linimentum Calcis*, B.P., consists of equal parts of olive oil and lime water, and is an excellent application to burns.]

Permanent baths of olive oil, similar to Hebra's continuous water bath, have been strongly recommended in cases of extensive burns, and are said to be more effacacious than the water baths (Wyssler).

Acaciæ Gummi.

Gum Arabic. Derived from several African species of Acacia. During the hot season it exudes from their trunk through natural or artificial openings in the bark. It is a combination of lime, magnesia, and potash, with Arabic acid (Arabin), an easily isolable substance. The acid itself is a carbohydrate. Very little of it is absorbed in the intestine, in passing through which it retains its glutinous and protective character. It may be given as an emulsion with oil, or simply dissolved in water. The simplest plan is to dissolve a teaspoonful of it in a glass of water, and to let the patient drink several such glasses during the day. This treatment is an excellent one for some forms of intestinal catarrh. Recently, gum arabic has been recommended as an addition to cow's milk in bringing up infants by hand (1 teaspoonful to each bottle). It prevents the precipitation of the casein in lumps, and keeps it suspended in fine flakes. This is an indication of great practical value.

It is not improbable that the addition to other drugs of a substance like gum, which is itself incapable of absorption, may often have the additional and very important advantage of retaining them in the stomach and bowel, and so prolonging their local action.

Preparations :—

(1.) *Mucilago Acaciæ*, B.P. (Gum arabic, ℥ iv., water, f℥ vj.) *Dose*, fʒ j.—℥ ss. (U.S. Gum arabic, ℥ iv., water, ℥ viij.) *Dose, ad libitum.* The mucilage should not be kept long before using, otherwise it becomes sour from the development of lactic and acetic acids.

(2.) *Syrupus Acaciæ*, U.S. (Gum arabic, syrup ; 1 in 12.) *Dose, ad libitum.*

Lycopodium, U.S., *Lycopodium seeds.* Obtained from Lycopodium Clavatum, a cryptogamous plant, growing in northern and central Europe. The fructification consists of small reniform capsules, which contain a number of tiny spores. The latter have a fatty coating which gives them a slippery feel, and makes them adhere to the skin. They contain a fatty oil, a gummy extractive substance, and other inactive constituents. Lycopodium used to be prescribed in irritative conditions of the urinary organs as an infusion of 15·0 in 150·0 water; it was also given in diseases of the respiratory and digestive organs. It can be made into an emulsion with mucilage. Lycopodium is still much used as a convenient dusting powder in intertrigo of the nates, groins, and mammæ. For this purpose it may be mixed with a tenth part of finely powdered oxide of zinc.

Radix Althææ, U.S.

Marsh Mallow. From Althæa Officinalis (Malvaceæ), which grows wild in temperate climates. The root contains much vegetable gum (a carbo-hydrate isomerous with arabin), and starch. It has long been a popular remedy as a sedative in acute affections of the air-passages. The *Folia Althææ, Folia Malvæ, Flores Malvæ Vulgaris*, &c., are officinal in Germany, though none of them are retained in the British Pharmacopœia. They are used in the form of syrup, and in preparing so-called "pectoral" medicines.

Radix Glycyrrhizæ.

Liquorice root. Derived from Glycyrrhiza Glabra (Papilionaceæ), a native of the south of Europe. Its chief constituent is Glycyrrhizin, a yellowish glutinous glucoside, which causes diarrhœa if given in large doses (15·0—30·0), is quite inactive in small doses, and is only partly decomposed in its passage through the intestine (Buchheim).

Preparations :—

(1.) *Extractum Glycyrrhizæ*, B.P. A watery extract of the root, which may be used with advantage to cover the taste of unpleasant medicines, for which purpose it is far superior to syrups (Aurantii, &c.), which, instead of improving the taste of the drugs, often only render them more nauseous. *Dose*, of *Ext. Glycyrrhizæ* B.P., ℥ ss.—j. The U.S. Pharm. has *Ext. Glycyrrhizæ Fluidum*, (Liquorice, glyerin, water, alcohol.) *Dose, ad libitum.*

(2.) *Pulvis Glycyrrhizæ Compositus*, B.P. (*vide* Senna).

(3.) *Extractum Glycyrrhizæ Liquidum*, B.P. (Contains ⅛ of its volume of rectified spirit, and 2 fluid ounces are equal to 1 of solid extract.) *Dose*, ʒ ℥j.

(4.) *Mistura Glycyrrhizæ Composita*, U.S. (Liquorice, sugar, gum arabic, āā ℥ss.; tinct. camph. co., ℥ij., vinum antimonii, ℥j., spts. æth. nit., ℥ss., water, ℥xij.) *Dose*, for an adult, ʒj.—℥ss.

Tubera Salep.

Salep root. The roots of several species of European Orchids. They chiefly contain bassorin (about 45 per cent.), a carbo-hydrate, which does not dissolve in water, but only swells up and forms a glutinous mass which is incapable of absorption by the digestive tract. The roots are almost exclusively used in intestinal catarrh, in the form of a decoction of 1—2 grammes in 150·0 water and some sugar. The use of tannic acid in combination with decoction of salep is bad practice, since the tannin precipitates the bassorin. In cases of prolonged irritation of the bowel, *e.g.*, in typhoid fever, a more diluted decoction can be allowed, *ad libitum*, as a drink. In ordering salep in infantile diarrhœa we should avoid the not uncommon mistake of believing that it has any real nutritive properties. It contains about 27 per cent. of starch, 5 per cent. of albumen, and 1 per cent. of sugar (Dragendorff), so that the amount of nutriment in the quantity used in making the decoction must be very small indeed. On the whole, it is doubtful whether salep renders more service than gum arabic, a far more manageable drug.

The *Mucilago Salep*, Pharm. Germ., consists of 1 pt. salep, 10 pts. of cold, and 90 pts. of boiling water, and must be always freshly prepared at the time of using.

Carrageen, *Irish Moss.* Derived from Chondrus Crispus, one of the North Atlantic Algæ. It contains a great deal of gum and gelatin (nearly 80 per cent.), besides the salts which are dissolved in sea water. The alga dissolves in boiling water completely, with the exception of a little vegetable fibre, and becomes solid on cooling if sufficiently concentrated. One gramme produces about 25·0 of jelly. Probably it was its external resemblance to the so-called "extracts of meat," which led many medical men to attribute special nutritive properties to the carrageen. It is, however, a useful remedy in irritated conditions of the mucous membrane of the bowel. With regard to its use in affections of the air-passages we must refer to the general remarks at the beginning of this chapter. It can be given as a decoction of 5·0 in 300·0 water.

[The following emollient drugs are also officinal:—

Ulmi Cortex. The inner bark of Ulmus Campestris, common elm, and Ulmus Fulva, slippery elm.

Preparations:—

Decoctum Ulmi, B.P. (Elm bark, distilled water; 1 in 8.) *Dose*, ℥ ij.—iv.

Mucilago Ulmi, U.S. (Slippery elm bark, ℥ j., boiling water, ℥ xvj.) *Dose, ad libitum.*

Sassafras Medulla, U.S. The pith of the stems of Sassafras Officinale.

Preparation:—

Mucilago Sassafras Medullæ. (Sassafras pith, gr. cxx.; water, Oj.; macerated three hours and strained.) *Dose, ad libitum.*]

CHAPTER V.

ADSTRINGENTIA—AMARA—ALKALINA.

ADSTRINGENTIA.

ASTRINGENTS.

THE members of this class have a direct action upon the vessels, or the connective tissues, and they are generally locally applied. The most ancient of these drugs is the

Cortex Quercûs.

Oak bark. Derived from Quercus pedunculata, sessiliflora, and alba (Cupuliferæ). Owing to the quantity of tannin which it contains, it is used externally in the form of *Decoctum Quercûs*, B.P., U.S. (1 in 16), as an astringent lotion, &c., and [especially as a vaginal injection in leucorrhœa. It has the disadvantage, however, of staining the linen.] It is now more usual to use the pure tannic acid, or tannin, instead of the bark. This substance is obtained from the gall nuts which are formed on the leaf buds of Quercus Infectoria after puncture by the female gall insect (Cynips Gallæ). These nuts are rounded, greenish grey growths which serve as a receptacle for her eggs. The acid extracted from them.

Acidum Tannicum ($C_{14}H_{10}O_9$)

Is an amorphous, yellowish-white substance which has an acid reaction and forms salts with bases. Of late years, it has been regarded by chemists as *di*gallic acid.

Action.—Tannic acid is a body which, in the moderate quantities in which it is present in very many of our foods and beverages, does not injure the digestion in the least. It is perhaps owing to its power of precipitating albuminous substances that in large quantities it diminishes the secretion of the mucous membranes, and promotes the contraction of their tissues. It forms coagula with the elements of the blood. It has a great affinity for gelatin. In many cases it arrests fermentation and putrefaction. Part of it reappears in the urine as gallic acid.

Use.—(1.) To diminish secretion in many forms of catarrhal inflammation, *e. g.*, in that of the pulmonary and urinary tracts, in plugging of the renal tubules by fibrinous or epithelial casts; (2.) externally to check bleeding, especially of a parenchymatous nature.

(3.) As an alterative in a perverted state of the gastric and intestinal secretions; (4) as an antidote in poisoning by metals and alkaloids, with which it forms more or less insoluble salts if it reaches them in the intestine, and so renders them less readily absorbed. *Dose.* Internally from gr. iij.—xv. in powder, pills, or solution. [Externally the *Glycerinum Acidi Tannici*, B.P. (tannic acid, 1 pt., glycerin 4 pts.), is an excellent preparation, which can be diluted with water *ad libitum* to form gargles, &c. In the concentrated state, the glycerinum may be painted over the pharynx and tonsils in chronic inflammation of these parts.]

Preparation, U.S. :—

Glycerinum Acidi Tannici. (Tannic acid, ℥ ij., glycerin, Oss.)

Tannic acid has been recently much recommended as an inhalation in commencing phthisis (Leube), 30 c.c. of a 2 per cent. solution in water being inhaled three times a-day.

An aqueous solution of tannic acid becomes decomposed by the absorption of water into gallic acid ($C_7H_6O_5$), while at the same time the liquid turns brown, the change being promoted by an abundant development of fungi. One molecule of tannic acid forms two of gallic acid. This decomposition can be prevented by the previous addition of a little alcohol.

The preparations of tannic acid are, besides the glycerinum,

(1.) *Trochisci Acidi Tannici.* (½ gr. in each lozenge, B.P.; 1 gr. in each, U.S.)

(2.) *Suppositoria Acidi Tannici.* (Gr. iij. in each, B.P.; gr. v. in each, U.S.)

(3.) *Suppositoria Acidi Tannici cum Sapone,* B.P. (Tannic acid, glycerin of starch, curd soap, starch powder; gr. iij. in each.)

The U.S. Pharm. has *Unguentum Acidi Tannici* (gr. xxx. to ʒ j.)

Preparations of galls and gallic acid:—

(1.) *Tinctura Gallæ.* (Galls, proof spirit; 1 in 8, B.P., U.S.) *Dose,* ʒ ss.—ij.

(2.) *Unguentum Gallæ.* (Galls, gr. lxxx., benzoated lard, ℥ j., B.P.; galls, gr. lx., lard, ʒ vii., U.S.)

(3.) *Unguentum Gallæ cum Opio,* B.P. (Ointment of galls, ℥ j., opium, gr. xxij.)

(4.) *Glycerinum Acidi Gallici,* B.P., U.S. (Gallic acid, 1 pt., glycerin, 4 pts.) *Dose,* ♏x.—lx.

The following drug is officinal, Pharm. Germ.

Semen Quercûs Tostum. Acorn coffee; acorns roasted and ground. It contains tannic acid, and the products formed by the action of dry heat on the latter, and on the other organic constituents of the seeds. They consist of pyrogallic acid

($C_6H_6O_3$) and more complicated empyreumatic compounds, in quantity sufficient to excite gentle irritation. Acorn coffee has rather a beneficial action on the digestion. It is generally given as a substitute for coffee in cases where the latter is injurious, and it is also ordered as a stomachic especially in scrofula and rickets.

Several drugs may be considered as natural preparations of tannin, so far as their physiological effect is concerned. Samples of tannin from different species of plants do not however agree in all their chemical properties.

The following are officinal.

Kino.

Kino Gum. The inspissated juice of Pterocarpus Marsupium, an Indian papilionaceous tree. It consists of about 75 per cent. of tannic acid, the remainder being chiefly a reddish gum. It is used as an astringent and styptic. [Both it and the other substances containing tannic acid are incompatible with preparations of iron.]

Preparations :—

(1.) *Tinctura Kino*, B.P., U.S. *Dose*, ♏xxx.—ʒ ij.

(2.) *Pulvis Kino Compositus*, B.P. (Kino, cinnamon, and opium ; containing 1 gr. of opium in 20.) *Dose*, gr. v.—x. or more.

Catechu. A hard, dark brown shining extract, containing about 55 per cent. of tannic acid. It is derived from the East Indian Catechu-Acacia (Uncaria Gambir), by boiling the leaves and wood.

Preparations :—

(1.) *Infusum Catechu*, B.P. (1 in 27.) *Dose*, ℥ j.—ij.

(2.) *Tinctura Catechu.* (1 in 8, B.P. ; 1 in 10, U.S.) *Dose*, ʒ ss.—ij.

(3.) *Infusum Catechu Compositum*, U.S. (Catechu, cinnamon, water; 1 in 32.) *Dose*, ʒj.—℥ss.

(4.) *Pulvis Catechu Compositus*, B.P. (Catechu, kino, rhatany, cinnamon, and nutmeg; 1 in 2½.) *Dose*, gr. xx.—xl.

(5.) *Trochisci Catechu*, B.P. (1 grain of catechu in each.) *Dose*, 1—3 lozenges.

Radix Krameriæ.

Rhatany root. From Krameria Triandra, a Peruvian plant (Krameriaceæ). The outer coats of the root are said to contain about 40 per cent. of tannic acid. The *dose* of the powdered root is gr. x.—xxx.

Preparations:—

(1.) *Extractum Krameriæ*, B.P., U.S. *Dose*, gr. v.—xx.

(2.) *Infusum Krameriæ.* (1 in 20, B.P.; 1 in 16, U.S.) *Dose*, ℥ss.—ij.

(3.) *Tinctura Krameriæ.* (1 in 8, B.P.; 1 in 6, U.S.) *Dose*, ʒj.—ij.

(4.) *Extractum Krameriæ Fluidum*, U.S. (Rhatany, glycerin, diluted alcohol; 1 in 1.) *Dose*, ♏v.—xxx.

(5.) *Syrupus Krameriæ*, U.S. (Fluid extract of rhatany, ℥xij., syrup, ℥xxiv.) *Dose*, ʒj.—iv.

Folia Uvæ Ursi.

Bearberry leaves. Obtained from Arctostaphylos Uva Ursi (Ericaceæ), a Highland plant. It is said to contain 30 to 40 per cent. of tannic acid, as well as a glucoside (Arbutin), and another body, Urson, which has not yet been carefully examined. It is specially used in catarrh of, and in hæmorrhages from, the urinary organs, and it seems empirically possible that it may have some advantage over tannic acid as such, although the *rationale* of its action is unknown.

Preparations :—

(1.) *Infusum Uvæ Ursi*, B.P. (1 in 20.) *Dose*, ℥j.—ij.

(2.) *Decoctum Uvæ Ursi*, U.S. (1 in 16.) *Dose*, ℥ij.

(3.) *Extractum Uvæ Ursi Fluidum*, U.S. (1 in 1.) *Dose*, ʒ ss.—ij.

Hæmatoxyli Lignum.

Lignum Campechianum, Logwood. The heart wood of Hæmatoxylum Campechianum (Cæsalpiniæ). It contains tannic acid, and a colouring matter (Hæmatoxylin), which is at first yellowish, but afterwards turns a beautiful red. The latter passes unchanged into the urine. Logwood is an excellent astringent remedy in diarrhœa.

Preparations :—

(1.) *Decoctum Hæmatoxyli.* (Logwood, cinnamon; 1 in 20, B.P.; 1 in 16, U.S., without cinnamon.) *Dose*, ℥ ss.—ij.

(2.) *Extractum Hæmatoxyli.* (An aqueous extract.) *Dose*, gr. x.—xxx., B.P.; gr. v.—xx., U.S.

[**Coto Bark** (not officinal), the product of an undescribed species of tropical tree, and imported from Bolivia in South America, has lately been recommended in Germany as a remedy for diarrhœa. It is of a cinnamon-brown colour, with an aromatic smell and pungent taste. Several peculiar principles have been isolated from it, but it seems to owe its virtue to two, cotoin and paracotoin (Jobst), and especially to the former. The efficacy of the bark in catarrhal and other forms of diarrhœa has been confirmed by several good observers. In England a tincture (1 in 10; *dose*, ♏x., frequently repeated) has been prepared by Mr. Martindale, and a fluid extract by Messrs. Ferris. (*Vide* also *Note* in Appendix A.)]

[**Belæ Fructus**, B.P., *Indian Bael.* The fruit of Œgle Marmelos, from Malabar, also contains tannic acid. It has been chiefly used in dysentery as an astringent.

Preparation :—

Extractum Belæ Liquidum. (Bäel, rectified spirit, distilled water; 1 in 1.) *Dose,* ʒj.—ij.]

The metallic astringent tonics resemble the vegetable astringents in their action on the mucous membranes, though this action is generally a much more energetic one. The most powerful of them, and the one most in use is

Argenti Nitras ($AgNO_3$).

Lapis Infernalis, Nitrate of Silver. Officinal both as crystals, and fused into sticks. Under the action of light, and in the presence of organic substances, *e.g.*, the atmospheric dust, it becomes of a dark violet tint.

Action.—Owing to its great affinity for albumen, it acts on the tissues as a powerful caustic. In the stomach it forms albuminate of silver and chloride of silver. Part of the latter is absorbed into the blood, and if repeatedly administered for a long period becomes deposited, as finely divided metal, in the tissues of the body, and most markedly in the skin. This condition is known as *argyria.* In the lower part of the bowel sulphide of silver is formed.

Besides argyria, the following symptoms of chronic silver poisoning are stated to have resulted from the use of a hair dye containing nitrate of silver: general depression, a sense of oppression in the head, with impairment of memory, contraction of the muscles of the neck, slight deafness, with ringing in the ears owing to catarrh of the pharynx and

Eustachian tubes, weakness of vision, from spasm of certain of the ocular muscles, and chronic gastric, and intestinal, catarrh (Bresgen). The essential action of nitrate of silver is said to be to retard nutritive changes in all the animal tissues with which it combines (Krahmer). There is a diminution in the quantity of hæmoglobin, because the blood corpuscles alter their form, and give off more of it to the plasma under the influence of the silver. The alteration in the blood induces symptoms of chlorosis in the system at large, and catarrhal and other nutritive disturbances of a degenerative character occur in various tissues (Bogoslowsky). According to later experiments (Rouget) it is not the changes in the blood which cause symptoms of poisoning, but disturbances of the nervous centres which produce spasms and difficulty of breathing.

These toxicological facts are as yet insufficient to explain the therapeutic action of nitrate of silver, or to serve as indications for its more extended use. If given in small doses and carefully administered we can obtain with it undoubted cures without any injurious effect at all. I have only mentioned the above facts to prevent any possible misuse of the drug, and as supplying the only experimental knowledge of its properties, which we at present possess.

Internal use.—(1.) In chronic catarrh, erosions, and ulcerations of the stomach and intestines.

Besides true gastric ulcer it is in the severe forms of infantile diarrhœa that nitrate of silver often does excellent service.

(2.) In gastric pain (cardialgia), without any actual disease of the stomach; for example, in hysterical persons, pregnant women, and in debilitated patients. In such cases, a solution of the salt is the best form in which to give it (Krahmer).

(3.) Empirically in epilepsy (Heim, Romberg).

A distinct improvement is only obtained with it in a few cases, but it should be always tried, if not distinctly contra-indicated. The total quantity administered should not, however, exceed 15·0, lest argyria supervene.

(4.) Empirically in the early stages of progressive spinal paralysis (Wunderlich).

Here it has often an undoubtedly beneficial effect, but at present we are not able to define the special cases to which this treatment is applicable, and hence, in many instances, it has no action at all.

[*External use.*—In the solid form, as *Argenti Nitras Fusa* (*vide* Caustics), or in solution in distilled water (gr. ij.—x., and upwards, to ℥j.), as a lotion to ulcers, &c. In vesical hæmorrhage, gr. ¼—j., to ℥j. water as an injection (H. Thompson).]

Dose.—For an adult, gr. ⅙—⅓ in a pill with bread. [In infantile diarrhœa gr. ¼ in ℥ij. aquæ dest., *Dose*, ʒj. *omni horâ* (Niemeyer).]

[The following drug resembles nitrate of silver in its general properties, but has scarcely any caustic action.

Argenti Oxidum, *Oxide of Silver* (Ag_2O), B.P., U.S. An olive-brown powder, nearly insoluble in water. *Dose*, gr. ss.—ij. It is chiefly used in gastric catarrh and ulcer.]

Zinci Sulphas ($ZnSO_4$).

Sulphate of Zinc, White Vitriol. Small quantities become converted into chloride of zinc by the chloride of sodium present in the stomach, and this forms a combination with albuminates, which, owing to its solubility in dilute acids, can be absorbed into the blood (Mitscherlich).

Use.—Sulphate of zinc is given internally in chronic gastric catarrh as a tonic and astringent [also in chorea as a nervine tonic]. The dose for an adult, B.P., is gr. j.—iij. The Pharm. Germ. gives 0·01 to 0·06 as a dose, or generally speaking, about 0·2 : 150·0 water. It also serves as an emetic (gr. x.—xxx.), but can be dispensed with for this purpose. Its chief use is as an external, and very valuable, astringent and stimulant to wounds and mucous membranes. It is applied in aqueous solutions of various strengths [a useful one being gr. ij. ad ℥j. aq.]

Zinci Acetas ($Zn(C_2H_3O_2)2$), *Acetate of Zinc*, is used much in the same way as the above, but its local action is weaker. Both preparations are recommended as nervine tonics. The milder oxide of zinc has, however, quite enough sedative power, and if it should be necessary to increase this power by exciting the sensation of nausea, the two ordinary emetics (*Antimonium Tartaratum*, *Ipecacuanha*) will answer every purpose.

Cadmium, *Cadmii Sulphas* ($CdSO_4$), U.S., *Sulphate of Cadmium.* Is used externally as an astringent; as an ophthalmic ointment of the strength of 0·1 to 5·0 lard, as an eye lotion of 0·1 to 10·0, as an injection in gonorrhœa of 0·5 to 100·0, &c.

[The British Pharmacopœia only makes use of the Iodide of Cadmium in the form of *Unguentum Cadmii Iodidi.* (Iodide of cadmium, simple ointment; 1 in 8.) Its action resembles that of iodide of lead, but it does not stain the skin like that drug.]

Plumbi Acetas ($Pb2C_2H_3O_2$).

Acetate of Lead, Sugar of Lead. Whitish crystals with a sour smell, readily soluble in water when recently prepared.

Action.—In large doses it corrodes the lining membrane of the stomach, in small ones frequently repeated it produces chronic lead poisoning. It is only necessary here in treating of the therapeutic use of lead, to consider two out of the many interesting phenomena which occur in this condition. These are (1) the contraction of the muscles of the blood vessels in the first stage, which increases intra-vascular pressure, and consequently diffusion outwards, so that the blood mass is diminished through loss of part of its watery constituents (Hitzig). This cannot fail to react favourably upon certain morbid conditions. It is also not improbable that owing to the contraction of the blood vessels, the escape of the white blood corpuscles from the latter into the tissues, as described by Cohnheim, cannot take place so easily as under normal conditions. We must also take into account (2) the retardation of the peristaltic movements of the bowel caused by the drug, and which appears to be accompanied with narrowing of its calibre. The value of this indication in many affections of the intestine is self-evident. Authorities are not agreed as to whether these two phenomena are due to the effect of the drug on the nerves, or to its direct action on the muscles.

Use.—(1.) In obstinate diarrhœa; (2.) In internal hæmorrhage [especially that of typhoid fever].

(3.) In acute dyspnœa, due to œdema of the lungs, when it complicates chronic nephritis, and the pneumonia of drunkards (Traube, Nothnagel). Here large doses are indicated—0·05 every half-hour—a good-sized blister being applied to the chest at the same time. (4.) In Bright's disease, if not too far advanced, in which it is stated by Lewald, to diminish the amount of albumen in the urine, and to increase the quantity of water excreted. (5.) In cases of profuse secretion from the bronchi and in gangrene of the lung, especially as an inhalation. (6.) As an antiseptic and antiphlogistic injection into the bladder, 0·05—0·1 in 100·0 water (Traube). (7.) Externally as an astringent to mucous membranes and ulcers.

Dose.—0·01—0·06 several times a day in powder or pills, or 1—5 grs. three times a day. [In the hæmorrhage of typhoid fever, 3 grs. may be given with a few minims of dilute acetic acid, every four hours.]

Preparations of acetate of lead:—

(1.) *Pilula Plumbi cum Opio.* (Acetate of lead, 3 grs., opium, ½ gr., in 4 grs.)

(2.) *Suppositoria Plumbi Composita.* (3 grs. acetate and 1 gr. opium in each.)

(3.) *Unguentum Plumbi Acetatis*, B.P. (Acetate of lead, benzoated lard; 1 in 37½.)

Preparations of subacetate of lead ($Pb2C_2H_3O_2$, $2PbO$):—

(1.) *Liquor Plumbi Subacetatis.* (Acetate of lead, 5 pts., oxide of lead, 3½, distilled water, 20, B.P., U.S.)

(2.) *Liquor Plumbi Subacetatis Dilutus.* (Liquor plumbi, rectified spirit, distilled water; 1 in 80, B.P.; 1 in 42, U.S.)

(3.) *Unguentum Plumbi Subacetatis Compositum*, B.P. (Liquor plumbi, camphor, white wax, almond oil; 1 in 5¾.) *Ceratum Plumbi Subacetatis*, U.S., with olive oil instead of almond oil; same strength.

Liquor Plumbi Subacetatis is a powerful desiccant, and is valuable, *inter alia*, in the treatment of broad condylomata, which it causes to disappear rapidly and painlessly. The *Liquor P. Dil.* is frequently applied to the mucous membranes and to ulcerated surfaces.

The following compounds of lead are only adapted for external use:—

Plumbi Oxidum (PbO), Litharge. It appears in the form of pale brick red or orange scales.

Preparation:—

Emplastrum Plumbi. (Oxide of lead, 1 pt., olive oil, 2½ pts., water, 1 pt., boiled to the necessary consistence, B.P.; oxide of lead, ℥xxx., olive oil, ℥lvj., water, q.s., U.S.)

Plumbi Carbonas ($PbCO_3$), White Lead. A heavy white substance, insoluble in water.

Preparation:—

Unguentum Plumbi Carbonatis. (Carbonate of lead, simple ointment; 1 in 8, B.P.; 1 in 7, U.S.) Used as an astringent in eczema.

Bismuthi Subnitras ($Bi3NO_3,3BiH_3O_3$).

Subnitrate of Bismuth. Prepared by decomposing neutral nitrate of bismuth with water. It is insoluble in water, but soluble in the gastric secretion, and it is probable that its action on the mucous membrane of the stomach and intestine, which has not as yet been experimentally investigated, depends on its solubility in the latter. It reappears in the motions as such or else in the form of sulphide, but part of it is absorbed, for Lewald detected it in the milk of a suckling woman. In very large doses it is said to cause corrosion of the walls of the stomach.

Use.—(1.) In chronic catarrh of the stomach. (2.) In diarrhœa dependent on, or accompanying, ulceration of the intestine. (3.) In gastric pain with or without ulceration. [(4.) As a snuff (ʒ vj. with Pulv. Acaciæ Gummi, ʒ ij.) to coat the mucous membrane in nasal catarrh (Ferrier).]

Bismuth probably acts so efficiently in ulceration of the bowel and intestine, because but little of it is absorbed, and hence it comes into direct contact with the seat of the lesion. In that form of gastric pain which is said to be a pure neurosis, *Valerianate of Bismuth*, Pharm. Germ., is reputed to be valuable. It is insoluble in water, but soluble in hydrochloric acid, and has the odour of valerianic acid; it is doubtful however whether the nauseous acid when liberated in the stomach, really intensifies the action of the bismuth as it is reputed to do. The dose is gr. ss.—ij.

Preparations, B.P.:—

(1.) *Trochisci Bismuthi.* 2 gr. of the subnitrate in each.

(2.) *Liquor Bismuthi et Ammoniæ Citratis.* *Dose,* ℥ ss.—j.

The dose of the subnitrate itself is gr. v.—xx., and it is best given suspended in mucilage of tragacanth.

[*Bismuthi Carbonas* ($2(Bi_2CO_3O_2)H_2O$), *Carbonate of Bismuth*, B.P., *Bismuthi Subcarbonas*, U.S. A white powder, made by precipitating a solution of subnitrate of bismuth by carbonate of soda. Is used for the same purposes as the sub-nitrate. *Dose*, gr. v.—xx.

Bismuthi Oxidum (Bi_2O_3), *Oxide of Bismuth.* A yellow powder, prepared by the action of solution of soda on subnitrate of bismuth, is officinal, B.P. *Dose*, gr. v.—xv.]

[**Cerii Oxalas** ($CeC_2O_4+3H_2O$), B.P., U.S., *Oxalate of Cerium.* Prepared by acting on a soluble salt of the rare metal cerium with oxalate of ammonia. It is a white powder, insoluble in water, alcohol, and ether, but soluble in sulphuric acid. The salts of cerium resemble those of bismuth in their action on the stomach, but their use is almost entirely restricted to the treatment of the sympathetic vomiting of pregnancy, which they sometimes control very efficiently. *Dose*, of the oxalate, gr. j.—ij. or more.]

Borax ($Na_2B_4O_7$), Sodii Boras, U.S.

Biborate of Soda. Until lately it was regarded as a mild astringent, and earlier still as an emmenagogue. There is no doubt that it exercises a good effect on catarrh of the conjunctiva and other mucous membranes. Of late an antizymotic power has been attributed to it (Dumas), and it is even said to be able to prevent the decomposition of organic substances by emulsin, diastase, and myrosin. It is not known whether there is any connection between this property and its action on the mucous membranes. It is chiefly used as a gargle and eye lotion (3·0—6·0 : 150·0 water); it is also used as a lotion to eczematous eruptions of the face (10·0—150·0).

[Dissolved in glycerin as *Glycerinum Boracis*, B.P., *Glyceritum Sodii Boratis*, U.S. (borax, 1 pt., glycerin, 4 pts.), it is an excellent application to destroy the *oidium albicans*, or thrush fungus, also to relieve *pruritus pudendi*, dependent on eczema of the part in women. It is also a good application to moist eczema of the hairy scalp.]

To this class also belongs

Alumen ($AlK2SO_4$), B.P., **Aluminii et Potassii Sulphas**, U.S.

Alum. Sometimes given in powder internally in intestinal hæmorrhage or in diarrhœa, in doses of 0·1—0·3. (B.P., 5—15 grains). It is also much used as an external astringent, especially in conjunctivitis and leucorrhœa, in quinsy, and in several forms of laryngitis. The *Alumen exsiccatum*, made by driving off the water of crystallisation by heat, is exclusively used as a mild caustic. *Dose*, of ordinary alum, for external use, for a gargle, gr. x.—xij., ad ℥j. water; as a vaginal injection, ʒ ij. or more, ad Oj. aq.; as an eye lotion, gr. iij.—vj., ad ℥j. aq.

[The U.S. Pharm. also has *Aluminii Sulphas*, *Sulphate of Aluminium.* It is used externally as an astringent.]

Barii Chloridum ($BaCl_2$), U.S., *Chloride of Barium.* Is occasionally used as a lotion or eye-water (0·1—0·2 : 10·0 water). The salts of barium are poisonous; among other properties they cause complete paralysis of the automatic ganglia of the heart after a preliminary stage of stimulation (Böhm).

[The *Sulphide* of Barium, made into a paste with oxide of zinc and a little water (1 pt. to 4), and applied to hairy parts of the skin for about three minutes and then washed off, is a good depilatory.]

Preparation:—

Liquor Barii Chloridi, U.S. (Chloride of barium, distilled water; 1 in 4.) *Dose*, ♏v. [In diffuse, and multiple, cerebral sclerosis (Hammond).]

AMARA (BITTERS).

It is very probable that the medicinal effect of bitter remedies, using the word in a restricted sense and excluding such drugs as strychnia, quinia, &c., is limited, in the doses in which they are ordinarily given, to the stomach and intestines. In small doses they produce a kind of local irritation which is felt as hunger. Since the saliva is undoubtedly increased by their administration it has been supposed that the same is true of the other digestive secretions. As yet, however, there is no experimental proof that they promote the formation of peptones in healthy animals, and it is certain that in large doses they have a contrary effect and may even excite a morbid irritation of the gastric mucous membrane. Bitter remedies can limit or arrest abnormal processes of fermentation, and especially, as it seems, such as are due to the presence of definitely formed ferments, and hence they can also influence those further troubles which result from an abnormal production of acid in the stomach. Owing to the length of time during which the bitter principles remain in the intestine the above effect may be a very decided one. In this way they may assist in improving the general nutrition of the body. They have the additional advantage of being administrable for a longer period than acids can be.

It is usual to divide the bitters into *Amara pura*, *mucilaginosa*, *aromatica*, and *resolventia*. The *Amara pura* are represented by the following drugs:—

Folia Trifolii Fibrini, PHARM. GERM.

Trefoil. Derived from Menyanthes Trifoliata (Gentianaceæ) It contains Menyanthin, an amorphous glucoside. The leaves are given as an infusion or decoction of 3·0—5·0 to 150·0 water in atonic dyspepsia, acid fermentation in the stomach, and similar, especially nonfebrile, conditions. An *Extractum Trifolii Fibrinii* is given in Germany in doses of 0·5—1·0 in pills.

Radix Gentianæ.

Gentian root. Derived from Gentiana lutea, growing in the Alps. It contains a crystalline Gentio-picrin (glucoside), as well as Gentianic acid, an inactive substance.

Preparations :—

(1.) *Extractum Gentianæ* (*Aquosum*), B.P., U.S. *Dose,* gr. ij.—xv.

(2.) *Infusum Gentianæ Co.* (Gentian, fresh lemon peel, water ; 1 in 80, B.P. ; 1 in 32, U.S., with coriander, and prepared by percolation.) *Dose,* ℥ j.—ij., B.P. ; ʒ j.— ℥ ss. U.S.

(3.) *Mistura Gent.*, B.P., U.S. (Gentian, coriander, proof spirit, water.) *Dose,* ℥ ss.—j.

(4.) *Tinctura Gent. Co.* (Gentian, cardamoms, proof spirit ; 1 in 13½, B.P. ; 1 in 15, U.S.) *Dose,* ʒ ss.—ij. [In addition to their other ingredients the three last compound preparations contain bitter orange peel. All the preparations of gentian are incompatible with salts of iron.]

Extractum Gentianæ Fluidum, U.S. (Gentian, glycerin, alcohol ; 1 in 1.) *Dose,* ʒ ss.—ij.

[**Chirata,** *Chiretta*, B.P., U.S. The entire plant of Ophelia Chirata, or Agathotes Chirayta (Gentianaceæ), from northern India. It contains a very bitter principle, and is indicated in the same conditions as quassia and gentian. It is not, like the latter drug, incompatible with iron.

Preparations:—

(1.) *Infusum Chiratæ*, B.P. (1 in 40.) *Dose*, ℥ j.—ij.

(2.) *Tinctura Chiratæ*, B.P. (1 in 8.) *Dose*, ♏xv.— ʒ j., or more.]

Lignum Quassiæ.

Quassia. The wood of Quassia Amara, from Surinam (Simarubaceæ). Its chief constituent is Quassiin, a neutral, very bitter, crystalline body, which is poisonous to flies, but which in ordinary doses has the effect of a wholesome bitter upon the human subject. Quassia is often ordered in accordance with the indications given above, though it has not been proved to be in any way superior to some of the native bitters.

Preparations:—

(1.) *Extractum Quassiæ. Dose*, gr. iij.—viij., B.P.; j.—iij., U.S.

(2.) *Infusum Quassiæ.* (1 in 80, B.P.; 1 in 64, U.S.) *Dose*, ʒ ij— ℥ ij.

(3.) *Tinctura Quassiæ.* (1 in 27, B.P.; 1 in 15, U.S.) *Dose*, ʒ ss.—ij., B.P.; ♏v.— ʒ j., U.S.

The following drugs, owing to the large quantity of starch or gummy matter which they contain, are termed *Amara mucilaginosa*:—

Radix Calumbæ.

Calumba root. Derived from Cocculus Palmatus, an East African climbing plant (Menispermaceæ). Besides the crystalline bitter, Calumbin, it contains a quantity of starch, and the crystalline and harmless bitter alkaloid, Berberin, which is also present in several other plants. Calumba root is a bitter remedy, well suited to prolonged administration, especially in cases of sensitive digestive organs where diarrhœa is also present.

Preparations:—

(1.) *Extractum Calumbæ*, B.P. *Dose*, gr. ij.—x.

(2.) *Infusum Calumbæ.* (1 in 20, B.P.; 1 in 32, U.S.) *Dose*, ℥ j.—ij., B.P.; ℥ ij.—Oj., U.S.

(3.) *Tinctura Calumbæ.* (1 in 8, B.P., U.S.) *Dose*, ʒ ss.—ij.

(4.) *Extractum Calumbæ Fluidum*, U.S. (1 in 1.) *Dose*, ʒ ss.—ij.

[**Pareiræ Radix.** B.P., U.S. The dried root of Cissampelos Pareira (Menispermaceæ), from Brazil. It is used empirically in vesical catarrh and chronic pyelitis, and it is said to be a tonic resembling calumba. It contains from $\frac{1}{25}$—$\frac{1}{20}$ of its weight of an alkaloid, Pelosin ($C_{18}H_{21}NO_3$), uncrystallisable and insoluble in water, but forming very soluble salts. It also contains tannin. It is seldom prescribed alone.

Preparations:—

(1.) *Decoctum Pareiræ*, B.P. (1 in $13\frac{1}{3}$.) *Dose*, ℥ j.—ij.

(2.) *Extractum Pareiræ*, B.P. (An aqueous extract.) *Dose*, gr. x.—xx.

(3.) *Extractum Pareiræ Liquidum*, B.P., U.S. (Pareira, boiling distilled water, rectified spirit; 1 in 1, B.P.; the same with glycerin; 1 in 1, U.S.) *Dose*, ʒ ss.—ij.

(4.) *Infusum Pareiræ*, U.S. (Pareira root, boiling water; 1 in 16.) *Dose*, ℥ j.—ij.]

Cetraria.

Lichen Islandicus, Iceland Moss. Obtained from Cetraria Islandica, a lichen which also grows in some of the mountainous regions of Germany. It contains a peculiar form of starch (Lichenin), and the bitter Cetraric acid (Cetrarin). [Lichenin increases the amount of glycogen in the liver (von Mering).] The moss was formerly recommended as a specific in consumption. At present it has only the reputation of being a good bitter. It is officinal as *Decoctum Cetrariæ.* (Iceland moss, 1 pt., water, 30 pts., reduced by boiling to 20 pts., B.P.; 1 in 32, U.S.) *Dose,* ℥j.—ij., or more.

Preparations, Pharm. Germ.:—

(1.) *Lichen Islandicus ab Amaritie Liberatus.* The bitter acid is extracted by carbonate of potash, so that what remains is an ordinary emollient, which it is quite unnecessary to prepare in this way.

(2.) *Gelatina Lich. Isl.* (3 pts. of the lichen with 100 pts. water, evaporated to $\frac{1}{10}$, and sweetened.) It must be always freshly prepared. A tea or a dessertspoonful may be taken at a time.

The *Amara aromatica* contain an æthereal oil, whose action on the intestinal canal, as well as on more distant organs, must be taken into account in prescribing them.

The following are officinal:—

Cortex Cascarillæ.

Cascarilla. The bark of Croton Eleuteria, a shrub growing in the West Indian Islands (Euphorbiaceæ). The bark contains about 5 per cent. of æthereal oil.

Preparations:—

(1.) *Infusum Cascarillæ.* (1 in 10, B.P.; 1 in 16, U.S.) *Dose,* ℥j.—ij.

(2.) *Tinctura Cascarillæ,* B.P. (1 in 8). *Dose,* ʒss.—ij.

[**Cannellæ Albæ Cortex,** B.P., U.S. The bark of Canella Alba, from the West Indies. It contains some volatile oil and resin, and has an aromatic smell, and warm pungent flavour. It is a general stimulant, with a special action on the digestive apparatus (Bouchardat), probably because it comes into direct contact with the latter. It is used in atonic dyspepsia chiefly in combination with rhubarb as *Vinum Rhei*. *Dose*, of the powdered bark, gr. xv.—xxx.

Preparation, U.S. :—

Pulvis Canellæ et Aloes. (Socotrine aloes, 4 pts., canella, 1.) *Dose*, gr. x.—xx.]

Glandulæ Lupuli.

Hop glands, Lupulin. Obtained from Humulus Lupulus (Urticaceæ). A finely granular yellowish powder consisting of small oval glands. When fresh, it has an aromatic smell and a bitter taste. These glands are obtained by beating the freshly dried bracts of the hop.

Their *chief constituents* are a crystallisable bitter acid and an æthereal hop-oil. Lupulin has been regarded by many persons as a narcotic possessed of a more or less specific action on the sexual organs. It appears that it was only the volatile oil which gave rise to this idea, since if introduced into the blood in large doses, it causes stupefaction like every other æthereal oil.

Lupulin may be given in doses of gr. iij.—xv. (0·2—1·0) in powder or pills as a very serviceable stomachic, but beer brewed with plenty of hops, is equally, if not more, efficient.

Preparations :—

(1.) *Extractum Lupuli*, B.P. (Hops, 8, rectified spirit, 15, distilled water, 80.) *Dose*, gr. v.—x.

(2.) *Extractum Lupulinæ Fluidum*, U.S. (1 in 1.) *Dose*, ʒ ss.—ij.

(3.) *Infusum Lupuli* (*Humuli*, U.S.). (Hops, boiling distilled water; 1 in 20, B.P.; 1 in 32, U.S.) *Dose*, ℥j.—ij.

(4.) *Tinctura Lupuli* (*Lupulinæ*, U.S.). (Hops, proof spirit; 1 in 8, BP., U.S.) *Dose*, ℥ ss.—ij.

(5.) *Oleoresina Lupulinæ*, U.S. *Dose*, ♏ v.—xxx. and upwards.

(6.) *Tinctura Humuli*, U.S. (1 in 6.) *Dose*, ℥ ss.—ij.

The *Amara resolventia* are supposed to be characterised by the presence of certain substances which have an aperient action, and which have been believed to have a specific influence on the liver and spleen. The correctness of this view has not as yet been experimentally proved. The following Pharmacopœia drugs belong to this class:—

Radix Taraxaci.

Dandelion root. Derived from Leontodon Taraxacum, a common native Composite. The milky acid juice which exudes from it contains, *inter alia*, a crystalline bitter principle, and also an acrid crystalline resin.

Preparations:—

(1.) *Decoctum Taraxaci.* (1 in 20, B.P.) *Dose*, ℥ ij.—iv.

(2.) *Extractum Tar.*, B.P., U.S. *Dose*, gr. v.—xx.

(3.) *Succus Tar.*, B.P., U.S. (The expressed juice, 3 pts.; rectified spirit, 1 pt.) *Dose*, ʒj.—ij.

(4.) *Infusum Tar.*, U.S. (1 in 8.) *Dose*, ℥ ss.—ij.

(5.) *Extractum Tar. Fluidum*, U.S. (1 in 1.) *Dose*, ʒj.—℥j.

The German Pharmacopœia chiefly uses the following drug instead of Taraxacum:—

Herba Chelidonii.

Obtained from *Chelidonium Majus*, one of the native Papaveraceæ. It contains an abundance of acrid milky juice. Besides a peculiar acid, a bitter principle (Chelidoxanthin), as well as two alkaloids, Chelidonin and Chelerythrin, have been prepared from it. The latter is identical with Sanguinarin, which is extracted from Sanguinaria Canadensis (Papaveraceæ). Its sulphate, in doses of 0·02, produced a narcotic and irritant effect on rabbits (Probst). Chelidonin does not appear to be poisonous; it has a nauseous bitter taste.

Chelidonium is highly reputed as a drug which can promote the functional activity of the liver. It is generally given in the form of an extract, in doses of 1·0 or more, either alone or combined with other so-called cholagogues. Nothing definite is known about it experimentally.

[**Sanguinariæ Radix**, *Blood root.* The rhizome of Sanguinaria Canadensis is officinal, U.S. Its most important constituent is the Chelidonate of the alkaloid *Sanguinarin*, to which it owes its physiological properties. It is said to promote the hepatic and intestinal secretions (Bartholow), and also to have an emetic and expectorant action. Sanguinarin is a very slight cholagogue, rendering the bile more watery, but increasing its solids in a unit of time, and slightly promoting the intestinal secretion (Rutherford and Vignal.) Blood root is given in atonic dyspepsia, duodenal catarrh, bronchitis, and amenorrhœa. *Dose* of the alkaloid Sanguinarin, gr. $\frac{1}{12}$—$\frac{1}{8}$.

Preparations:—

(1.) *Tinctura Sanguinariæ.* *Dose*, ♏v.—xxx.

(2.) *Acetum Sanguinariæ.* (Blood root, diluted acetic acid; 1 in $7\frac{1}{2}$.) *Dose*, as an emetic, ʒiij.—iv.; as an expectorant, ♏xv.—xxx.]

Fel Bovinum Purificatum.

Purified Ox Gall. Occupies a peculiar position among bitter remedies. It chiefly consists of glycocholate and taurocholate of soda, the mucus having been removed by alcohol, the colouring matter by animal charcoal.

The importance of bile in the digestion of fats, has often led to its use in various forms of nutritive disturbance, but this practice has not been attended with success, because the bile simultaneously arrests gastric digestion. The property which the bile acids possess of depressing the pulse, the temperature, and the arterial pressure, as well as of dissolving the red blood corpuscles, which was partially known from the study of the phenomena of jaundice, but which has only recently been experimentally proved to belong exclusively to these acids (Röhrig and others), has also as yet remained without any therapeutic application. The chief reason of this is probably because their action on animals, when given by the stomach even in large doses, is so very much inferior to that obtained by injecting them directly into the blood.

Dose, gr. ij.—x. in suitable cases several times a day in pills or capsules.

ALKALINA (Alkalies).

What we have said about the action of bitters on the digestive organs is also true of the ultimate effects of the alkalies and alkaline earths in ordinary use, although the physical and chemical differences between the two groups are apparently so great. In *moderate doses*, as has been experimentally proved, they excite a more *abundant secretion of* *acid gastric juice*, and hence promote the digestion and nutrition, especially by removing existing disturbances; for an abundant supply of healthy gastric juice is the best disinfectant of the *primæ viæ*.

Although there is no direct proof of the fact, analogy leads us to believe that alkalies also promote oxidation in various parts of the organism. Besides this, they combine—at any rate, transitorily—with abnormal acids in the stomach. Perhaps, too, they have a perceptible effect in dissolving or decomposing the mucus which is secreted in catarrh of the stomach. Their value in poisoning with strong acids is self-evident. Several of them are also said to have a controlling or solvent influence over acids circulating in injurious quantities in the blood, as well as over the excessive formation of urate of soda, and its accumulation in the renal tubules and capillary blood-vessels. They have a certain amount of importance also in the treatment of urinary diseases, since most of them readily render the urine alkaline. The first member of this group is

Sodæ Carbonas (Na_2CO_3).

Carbonate of Soda, Soda. This salt appears in the Pharmacopœia in two forms, as the simple purified carbonate, and as *Sodæ Carbonas Exsiccata*, in which the water of crystallisation has been driven off by heat. It is much used in various acute and chronic affections of the stomach, either alone or in combination with other salts or with bitter drugs. In chronic catarrh of the bile ducts and in gallstone it is a valuable remedy, especially in the form of Carlsbad salts (*vide infra*, Sodæ Sulph.). It is often used in gout and acute rheumatism with the view of neutralising the free acids (uric acid, oxalic acid, and lactic acid—the latter purely hypothetical), to which these diseases are supposed to be due.

The *dose* of *sodæ carbonas* is gr. x.—xl.; of *sodæ carb. exsiccata*, gr. v.—xx. The latter form is convenient if we wish to administer the drug in pills.

[Externally, carbonate of soda in aqueous solution sometimes relieves the itching of the skin in eczema, lichen, and urticaria, *e.g.*, sodæ carb., ʒj. : ℥ vj.—viij. aquæ. dest.]

The next salt may be regarded as a preparation of carbonate of soda.

Sodæ Bicarbonas ($NaHCO_3$).

Bicarbonate of Soda. Owing to its slighter alkalinity, the taste and action of this salt are milder than that of the carbonate. It is, therefore, often preferred to the latter in the diseases above mentioned; and also if we wish for the local effect of carbonic acid at the same time. It can be given in larger doses than the carbonate. We are still in ignorance why both the carbonate and the bicarbonate produce such good effects in many cases of diabetes, although there is no doubt of the fact. Perhaps they diminish the diastatic action of the intestinal juice and other similar ferments (Cornillon and Bretel). Here they must be given in large doses (up to 20 grammes *pro die*, Griesinger). The *Trochisci Sodæ Bicarbonatis* (soda, sugar, mucilage of gum acacia, B.P.; with nutmeg also, U.S.) contain 5 grs. in each lozenge. With regard to the use of the salt in effervescing powders *vide Acidum tartaricum*.

Preparation :—

Liquor Sodæ Effervescens, B.P. (A solution of gr. xv. bicarbonate of soda in ℥ x. water, saturated with carbonic acid gas, at a pressure of seven atmospheres.)

Sodæ Acetas ($NaC_2H_3O_2$), *Acetate of Soda.* This salt is converted into the carbonate within the body. Since in large doses its action on the stomach is less caustic than that of the latter, it can be substituted for it with advantage, where we wish to produce an effect on distant organs. The *dose* is gr. xv.—cxx., in powder or solution.

[**Soda Caustica** (NaHO), *Caustic Soda*, is sometimes used as an antacid in the form of the following preparation:—

Liquor Sodæ. (A solution of caustic soda of sp. gr. 1·047, B.P.; 1·071, U.S.) *Dose*, ʒ ss.—j., B.P.; ♏ij.—x., U.S.]

Lithiæ Carbonas (Li_2CO_3).

Carbonate of Lithia. Lithia exceeds all other bases in its power of dissolving uric acid. Pieces of cartilage impregnated with urate of soda when immersed in solutions of the carbonates of potash, soda, and lithia of the strength of 1 pt. in 500 were most rapidly deprived of the acid by the carbonate of lithia. The potash salt had a very slight effect, and the soda scarcely any in the same period of time (Garrod). On theoretical grounds, therefore, this preparation is given in gout and in cases in which uric acid gravel is passed by the urine. Many mineral waters contain lithia—for example, those of Bilin and Weilbach. It is excreted in the urine (Neubauer).

The *dose* is gr. ss.—vj. several times a day. Since the drug is not without a slight prejudicial effect on the digestion, it is better to begin with small doses.

Preparation:—

Liquor Lithiæ Effervescens, B.P. (10 grs. Lith. Carb. dissolved in Oj. under a pressure of seven atmospheres.) *Dose*, ℥ v.—x.

[The *Lithiæ* (*Lithii*, U.S.) *Citras* is used for the same purpose as the carbonate, but is more soluble. *Dose*, gr. v.—x.]

Aqua Calcis (CaO,H_2O).

Lime Water. A saturated solution of lime made by allowing distilled water to stand for some time in contact with an excess of lime, and decanting. One pint contains about 11½ grs. lime. The lime absorbs carbonic acid, and may thus be of transitory value in cases of flatulence. Since lime water dissolves the fibrinous membranes of croup, it has been recommended in the form of spray or inhalation in croupous and diphtheritic laryngitis. It diminishes the amount of secretion in catarrh of the air passages and of the bladder, and its local application in dysentery in the form of an injection, would probably help to dissolve the false membranes. It has also been administered in gout as well as in rickets and osteomalacia. In the two latter, the action of lime is most probably due to the larger quantity of it which is thus supplied to the bones, whose normal proportion of lime has been lessened, owing to disturbing causes which are still not fully understood. The ingestion of chalk at first diminishes the amount of phosphoric acid in the urine, owing to the formation of phosphate of lime in the bowel. Part of the latter is excreted with the fæces and part is absorbed (Riesell). Experiments on animals (Roloff), as well as a number of clinical facts, support the view that the increased quantity of lime in the circulation benefits the diseased bone tissue.

Lime water is given internally in doses of ℥ ij.—iv. [It may be mixed in various proportions with milk. The *Liquor Calcis Saccharatus*, B.P., is a convenient form for administering lime, much more of which is held in solution by syrup than by simple water. One ounce of this preparation contains about 8 grs. of lime. The *dose* is ♏xv.—ʒj. for an adult. It is a valuable addition to cow's milk for hand fed infants, ♏x.—xv. or more being given in each portion of food.]

The following substances may be regarded as preparations of lime, since it plays the principal part in their composition :—

Calcis (Calcii, U.S.) Carbonas Præcipitata, B.P., *Precipitated Carbonate of Lime* in a finely divided, and hence an easily assimilable form. It is much prescribed in abnormal acidity of the *primæ viæ.* It is often extremely useful in arresting chronic diarrhœa. *Dose,* gr. x.—c., in powder, or suspended in mucilage. Æthereal oils or bitter drugs may be given with it.

[**Creta Preparata,** B.P., U.S., *Finely levigated Chalk,* from which the impurities have been removed by washing. Chiefly used as an antacid and astringent in catarrhal diarrhœa, both of children and adults, in one of the following forms ; also as an antidote in oxalic acid poisoning. *Dose,* gr. x.—lx.

Preparations :—

(1.) *Mistura Cretæ.* (Prepared chalk, gum arabic, syrup, cinnamon water ; 1 in 34, B.P. ; the same with glycerin and water ; about 1 in 18, U.S.) *Dose,* ℥ ss.—ij. ; for an infant, ʒ j.

(2.) *Pulvis Cretæ Aromaticus,* B.P. (Prepared chalk, cinnamon, nutmeg, cloves, cardamoms, saffron, sugar ; 1 in 4 nearly.) *Dose,* ʒ ss.—j.

(3.) *Pulvis Cretæ Aromaticus cum Opio* (*vide* Opium, p. 9).

Testa Præparata, U.S., *Burnt Oyster Shells.* Chiefly carbonate of lime with about 2 per cent. of phosphate of lime. *Dose,* gr. x.—ʒ j., and upwards. Used in the acidity of infants.

Magnesiæ Carbonas ($3MgCO_3,MgH_2O_2$).

Hydrated Carbonate of Magnesia. An absorbent which is much used, and of which the greater part traverses the bowel unaltered. Only a small portion of it is dissolved after combination with acids, and passes into the circulation. If repeatedly administered, it is said to collect in the large intestine with the fæces in the form of concretions of ammoniaco-magnesian phosphate, which may give rise to unpleasant symptoms. Owing to its lightness, and to the slight adhesion of its particles, it is best given shaken up with water. In small doses of from gr. ij.—viij., it acts as an antacid; in doses of from gr. x.—xl. it is an aperient. [The *Magnesiæ Carbonas Levis*, B.P., only differs from Magnesiæ Carbonas in being prepared by precipitation *in the cold* by carbonate of soda from a solution of sulphate of magnesia, and drying at 212° Fahr. *Dose*, gr. x.—xx. as an antacid; ʒ ss—j. as a purgative.

Preparation :—

Liquor Magnesiæ Carbonatis, B.P. This is a solution of carbonate of magnesia in water and carbonic acid gas. Each fluid ounce contains about gr. xiij. of the salt. *Dose*, ℥ j.—ij.]

Magnesia (MgO). Prepared by heating carbonate of magnesia to redness. It absorbs very large quantities of carbonic acid gas, and hence is quickly converted in the stomach and intestine into the bicarbonate. One gramme, if well calcined, will take up 1·091 cubic centimetres of carbonic acid. Hence, calcined magnesia may sometimes be of special use in distension of the bowel with flatus. As a rule, however, its chemical property is very imperfectly developed in the bowel. The accumulation of gas checks its further action as an absorbent, and the carbonic acid which it is able to absorb is thus only a fraction of what is actually present. It often serves as an aperient. It should alone be used in poisoning by corrosive acids, for the excess of carbonic acid which develops from the carbonate is liable to give rise to the formation of emboli in any vessels which may be laid open.

Calcined magnesia forms part of the officinal *Antidotum Arsenici* of the German Pharmacopœia. (*Vide infra.*)

Dose, of *magnesia*, and of *magnesia levis*, gr. x.—lx. The *Trochisci Magnesiæ*, U.S., contain gr. iij. in each lozenge. *Dose*, as an antacid, 1—5.

In using these drugs as aperients a good plan of administering them is to give 10 or 15 grs. in water every two hours. *Magnesia levis* is contained in *Pulvis Rhei Compositus*. (*Vide* Rheum.)

Antidotum Arsenici,

Or officinal German *Antidote in Arsenical Poisoning*, is a thin brownish paste, which is only prepared at the time of using. Seven pts. magnesia are mixed with 120 water, and kept in one bottle, and 60 pts. Liquor Ferri Persulphatis Sp. gr. 1·318 are added to 120 water in another. The two preparations are mixed when the antidote is wanted. Hydrated peroxide of iron is precipitated owing to the decomposition of the persulphate by the magnesia, and sulphate of magnesia remains in solution. The peroxide forms with arsenious acid a combination which is much less soluble in the digestive juices than the acid itself. It must, however, be freshly prepared, because if kept it does not immediately combine with the latter. The magnesia also forms with arsenious acid a rather insoluble salt, and for this reason it has been chosen as the alkali for preparing the peroxide of iron. The sulphate of magnesia by its purgative action accelerates the removal of the compounds of arsenious acid with iron and magnesia from the bowel, in whose secretions they are still to a certain extent soluble. *Dose:* A few dessertspoonfuls of the above every quarter of an hour in some warm water.

CHAPTER VI.

PLASTICA.

REMEDIES PROMOTING TISSUE GROWTH.

THE compounds of *Potassium* are chemically allied to the alkalies which we have just been considering, but in their physiological properties they are chiefly related to the following group. A number of them have specific and mechanical uses, *e g.*, they are employed in the treatment of syphilis, and as aperients and caustics. Here, however, we shall only speak of those which have the ordinary action of alkalies, or which, as far as is definitely known at present, exert some special influence on the circulation and on tissue change.

The compounds of potassium have the following properties in common. In large doses they act as poisons on the muscles, and specially *on those of the heart*, whether they reach them through the circulation, or are brought into direct contact with them. This action is not appreciably affected by the presence of the acids and haloids with which the potassium happens to be combined. The contractile substance of the muscles is an albuminate of potash with special properties, and an increased supply of potash to it probably alters its chemical constitution, and hence its normal functions. The heart is first stimulated to increased activity, and then paralysed, so that finally it ceases to react to the strongest ordinary stimulus. The salts of potash play an important part in the development of the animal tissues, and of the blood, as is clearly proved by the fact that food which in itself is not sufficiently nutritious—for example, over-stewed meat—recovers its properties completely on the addition of these salts and of a little chloride of sodium. If, on the contrary, we give potassium salts in the form of meat broth, which is very rich in them (the ashes contain more than 80 per cent.), *without* the addition of any other nutritive substances, they accelerate the tissue changes so enormously that animals fed on the broth died earlier than those which were kept entirely without food (Kemmerich). In men, too, more active tissue changes have been proved to follow the ingestion of potassium in the form of KCl, as estimated by the increased excretion of common salt (Bunge), as well as of urea (Aubert and Dehn). Plants show us how important a factor potassium is in promoting cell-growth. Vegetation supplied with nourishment in which this metal is alone deficient behaves just as if it were receiving nothing but pure water. Neither assimilation nor increase of weight occurs, because without the presence and help of potassium in the chlorophyll granules no starch is produced.

Large doses of potassium salts depress the reflex irritability of certain parts of the spinal cord. This has been proved in experiments on frogs, but many clinical facts seem to show that it is true also of the human subject. In warm-blooded animals such doses cause a weakening of motor power, while the electrical irritability of the peripheral nerves and muscles is retained. In healthy men a feeling of weight and fatigue is experienced in the limbs, but this only happens (in the case of absorption by the intestine) after the administration of a few of the most easily diffusible salts, such as the nitrate, the oxalate, and, in a less degree, the chloride, bromide, and iodide of potassium. Its other salts only enter the blood slowly and in limited quantity (Buchheim).

It is remarkable that in persons with fever, while the excretion of sodium salts by the urine diminishes, that of the potassium salts considerably increases (Salkowski).

The officinal preparations which have to be considered here are the following:—

Hydrate of Potash (KHO). *Vide infra,* Chapter XI., *Cauteria.*

Potassæ Carbonas (K_2CO_3).

Carbonate of Potash. Prepared from the crude pearl ash by washing with water and recrystallising, so as to remove sulphates, silicates, and chlorides. *Potassæ Bicarbonas* ($KHCO_3$) is prepared from the preceding by saturating it with carbonic acid gas, and repeatedly recrystallising.

A very pure carbonate can be made by heating the bicarbonate to redness. Owing to their hygroscopic properties, these salts are liable to variations in weight.

Dose of carbonate of potash, gr. ij.—x. or xv.; of bicarbonate of potash, gr. x.—xx.

Preparation:—

Liquor Potassæ Effervescens, B.P., *Potash Water.* (Bicarbonate of potash, gr. xxx., water ℥ xx., saturated with carbonic acid gas at a pressure of seven atmospheres.) *Dose,* ℥ v.—x.

The action of these compounds, as far as the digestive tract is concerned, corresponds to that of the carbonates of soda, but owing to their stronger basicity they more readily act on the mucous membranes as caustics. With reference to tissue changes in the body, we must recollect that these salts are important constituents of the red blood corpuscles, the muscles, &c. We should always prefer the carbonates of potash to those of soda in treating cases of dyspepsia in which we wish to improve the quality of the blood at the same time. The organism obtains a sufficient supply of sodium through the common salt which is taken with the food.

Potassæ Acetas ($KC_2H_3O_2$).

Acetate of Potash. Prepared by the action of dilute acetic acid on bicarbonate of potash. It has so great an affinity for water that it is impossible to dry it completely at low temperatures. It passes into the urine as carbonate, and there is no doubt that it promotes diuresis. It is said to have a special "resolvent" action on the liver and spleen. It is often given in gout with good effect. Since in large doses it does not injure the digestion so much as the carbonate of potash, and since it is converted into that salt in the blood, it may be prescribed as a convenient substitute for it in cases where the latter is indicated with a view to promote tissue change. *Dose*, gr. viij.—lx.

Potassæ Sulphas (K_2SO_4), *Sulphate of Potash.* Seldom used alone. It is contained in the *Pulvis Ipecacuanhæ Compositus* and *Mistura Ferri Composita.* It is sometimes used as a purgative in doses of gr. xv.—lx. [According to Wade, confirmed by Rutherford and Vignal, it is a cholagogue, though probably of rather uncertain action.]

Owing to our want of an accurate acquaintance with its properties we may here provisionally place the following drug:

Potassæ Nitras (KNO_3), *Nitrate of Potash, Saltpetre.* This salt was formerly supposed to have a powerful antipyretic and cooling effect when given internally. There is, however, no objective proof of this hypothesis. Saltpetre, when introduced directly into the blood, paralyses the heart's action like all other potassium salts. (0·3 killed a middle-sized dog, while 0·12 produced a rise in arterial pressure with diminution in the frequency of the pulse—Traube.) One gramme taken by an adult in a single dose on an empty stomach, gave rise to gastric uneasiness, vomiting, and loss of appetite of long duration (Kemmerich). If a larger dose be given enteritis may be produced. This is partly due to the intense diffusion which occurs (Buchheim). Perhaps the following considerations are also of importance: All organic substances which reduce peroxide of hydrogen—that is to say, mainly protoplasm and fibrin—convert the nitrate, even if exposed to the air, into nitrite (Schönbein). The same thing occurs within the body in the muscles *during exercise* (Gscheidlen); but since the nitrate reappears in the urine as such, we must imagine that an active exchange of nascent oxygen takes place between it and the tissues, and so produces its corrosive effect. If the latter occurs at the same moment as the paralysing action of the potassium, the salt, as has so often been proved, becomes a poison.

Local inflammations excited artificially in animals can be checked by the subcutaneous injection of saltpetre. The animals at the same time lose flesh (Samuel).

The *use* of saltpetre in medicine will only be justified after we obtain further clinical observations as to its value than those we at present possess. Its *dose* has generally been from gr. x.—xxx., but it has usually been given in combination with a number of other drugs (digitalis, opium, &c.), which would naturally make it impossible to control its action.

Owing to the large quantity of potassium salts which it contains, we must here consider the

Extractum Carnis Liebig.

An *Extract of Meat* which is quite free from fat, and almost free from sodium salts, while it contains a quantity of chloride of potassium, and a rather large amount of phosphates of lime, magnesia, and potassium, as well as a little iron.

Its *Action* on the digestive organs, the nervous system, and the heart, and the slight influence which it appears to exert over the temperature of the blood, are not exclusively due to the potassium salts which it contains, but partly also to the extractive matter, and, as has been definitely proved (Bogoslowsky), to the *Creatinin* ($C_4H_7N_3O$), of which the Liebig's extract contains from 2—3 *per cent.* It is a basic substance, which is derived from Creatin during the preparation of the extract by the removal of one molecule of water from the latter. It still retains gently stimulating properties when converted into a neutral salt. To the Creatinin and the potassium combined is due the death by paralysis of the heart, which is the result of feeding animals on concentrated meat extract. The so-called extractive matters have not yet been further examined.

Extract of meat does not contain gelatin, or, at any rate, only very minute quantities of it. Hence it differs very materially from the so-called Bouillon tablets of commerce, as can be easily proved by testing samples of each with alcohol. The gelatin is insoluble in the latter, whereas at least 56 per cent. of the extract of meat ought to be dissolved by it.

A teaspoonful of the extract dissolved in a teacupful of hot water, with the addition of a little common salt, is an excellent analeptic.

MARTIALIA.

PREPARATIONS OF IRON.

These consist of metallic iron and of several oxides and salts of iron, as well as of mixtures of the latter with other drugs. As might be expected, they differ from one another very much in their *Physiological action;* in the following respects, however, they all more or less agree:—

In the mouth the soluble salts have an astringent taste. In the stomach they produce no effect whatever in small doses, while in larger ones they readily disturb the digestion, and cause a feeling of pressure at the epigastrium, eructation, and loss of appetite. Several preparations combine with the albumen of the chyme, and form albuminates soluble in acids. One portion is absorbed in this form, and passes into the hæmoglobin of the blood, this substance being as dependent for its development on the presence of iron as is the chlorophyll of plants. Another, and probably the larger portion, is converted into sulphide of iron, and excreted by the bowel. The contact of the latter with the mucous membrane generally causes a certain amount of constipation. If a solution of iron be injected into the blood of an animal, the metal soon appears in abundance as an albuminate on such secreting surfaces as generally pour out albuminate secretions (Buchheim). The reason of this is that the white blood corpuscles in every part of the body assimilate the albuminate of iron, if its particles be sufficiently minute (H. Quincke).

When given as a medicine it also passes into the milk of suckling women in larger quantities than normal (Lewald).

The following facts have been proved by the careful observation of a number of patients (Pokrowsky).

The temperature of the body rose after the administration of iron, not only when abnormally low, but also when completely normal. This elevation sometimes did not occur for several hours, and often not for several days. The normal temperature once raised did not return to its former level for a long time. The temperature, which was morbidly low, rose rapidly, and as rapidly fell again when the iron was discontinued. The pulse, too, increased in frequency after a certain time, though not invariably. In correspondence with this fact, a rise in the blood pressure was noted in rabbits, to whom iron had been given (Laschkewitsch). The amount of urea excreted is said to have been increased, and the patients are also said to have gained weight, from which we may conclude that they developed fat. Sometimes the quantity of urine passed was distinctly increased. Dropsical effusions due to heart disease disappeared, but returned when the iron was discontinued. Dyspnœa also improved. In both these instances digitalis had been unsuccessfully tried.

[In several cases of acute rheumatism, treated with tincture of perchloride of iron, B.P., ♏xv.—lx., *quartis horis*, a remarkable diminution in the frequency of the pulse has been noticed at and after the time when the temperature became normal. With a natural rhythm and force the pulse-beats have fallen as low as 40, 30, and even 28 per minute (Russell Reynolds).]

Use.—In all cases in which for any reason the improvement of the quality of the blood is indicated, but where fever is absent, and the functions of digestion are not seriously impaired. Naturally that condition of the blood which goes under the name of *anœmia* is the most amenable to the influence of iron. Chlorosis in women at the time of puberty may be regarded as its most frequent expression.

Owing to the chemical relationship between **Manganese** and iron it has often been suggested that the former should be substituted for, or administered with, the latter as an internal remedy. It is said that in such cases the cure of chlorosis has been affected, when it had previously resisted other treatment. The *Carbonate of Manganese* ($MnCO_3$) is generally given in doses of gr. iss—iij.

The U.S. Pharm. orders the sulphate, *Manganesii Sulphas* ($MnSO_4$) in doses of gr. ij.—v.

The black oxide of manganese, *Manganesii Oxidum Nigrum* (MnO_2) is chiefly used in the preparation of chlorine. If given internally the dose is gr. ij.—x.

Manganese is poisonous in large doses. In animals it causes general paralysis, which may culminate in complete prostration; at the same time, the heart's action ceases owing to the direct effect of the drug on the motor apparatus. The liver appears to undergo fatty degeneration. A larger quantity of urea than normal is excreted. In a number of parallel experiments with iron, the latter drug failed to produce a single one of the toxic effects of manganese above enumerated either in cold or warm-blooded animals (Laschkewitsch).

Some preparations of iron are used to produce special effects.

The tonic preparations are:—

Ferrum Redactum, B.P., U.S.

Reduced Iron. Prepared by reducing glowing peroxide of iron with a current of hydrogen gas. It is given in doses of gr. ij.—v. in powder or pills, and is a tolerably digestible preparation. Ordinary metallic iron in the form of fine filings is liable to contain sulphur, and so to give rise to the evolution of sulphuretted hydrogen in the digestive tract. Even very small quantities of the latter may excite unpleasant eructation.

Preparation:—

Trochisci Ferri Redacti, B.P. (Gr. j. of reduced iron in each lozenge.) *Dose,* 1—6 lozenges.

Metallic iron (as wire) is contained in *Mistura Ferri Aromatica,* B.P. (Pale cinchona bark, calumba, cloves, tinct. cardamomi co., tinctura aurantii, peppermint water.) *Dose,* ʒj.—ij.

Ferri Peroxidum Humidum, B.P., U.S. ($Fe_2H_6O_6$).

Moist Peroxide of Iron. Made by precipitating a solution of persulphate of iron with soda or ammonia. It forms a reddish brown mass. *Dose,* ℥ ¼—ss. It is used as an antidote in arsenical poisoning, since the compound it forms with arsenious acid in the stomach is but very slightly soluble. It must be freshly prepared.

[**Ferri Peroxidum Hydratum,** B.P., U.S.

Hydrated Peroxide of Iron. Is simply the previous salt from which the water has been driven off by heat. *Dose,* gr. v.—xxx.

It is contained in the *Emplastrum Ferri,* B.P. (peroxide of iron, Burgundy pitch, lead plaster), a plaster whose reputed tonic properties are very questionable.

The *Empl. Ferri,* U.S., contains subcarbonate of iron instead of hydrated peroxide].

Ferri Carbonas, B.P., **Subcarbonas,** U.S. ($FeCO_3$).

Carbonate of Iron. Made by precipitating a solution of sulphate of iron with carbonate of soda or ammonia. It is a reddish brown powder. When rubbed up with sugar and dried, it forms the *Ferri Carbonas Saccharata,* B.P. *Dose,* of the latter, gr. v.—xx.

Preparations :—

(1.) *Mistura Ferri Composita,* B.P., U.S., *Griffith's Mixture.* (Carbonate of iron, sulphate of potash, myrrh, spirits of nutmeg, sugar and rosewater, B.P.; spirits of lavender instead of nutmeg, U.S.) *Dose,* ℥ ss.—ij.

(2.) *Pilula Ferri Carbonatis.* (Saccharated carbonate of iron, confection of roses, B.P.; carbonate of iron, honey, syrup, U.S.) *Dose,* gr. v.—x.

(3.) *Pilulæ Ferri Compositæ,* U.S. (Myrrh, carbonate of sodium, sulphate of iron, syrup). *Dose,* 1—2 pills.

(4.) *Trochisci Ferri Subcarbonatis*, U.S. (Subcarbonate of iron, vanille, sugar, mucilage of tragacanth; gr. v. of subcarbonate in each.) *Dose*, 1—3.

Ferri Lactas ($FeC_6H_{10}O_6$), U.S.

Lactate of Iron. An easily assimilable salt of a greenish white colour. *Dose*, gr. ij.—x.

Ferri Acetas, *Acetate of Iron*, is only officinal in the form of *Tinctura Ferri Acetatis*, B.P., made by decomposing a solution of ferric sulphate with acetate of potash, and adding rectified spirit. *Dose*, ♏v.—xxx.

Malate of iron is officinal in Germany as

Extractum Ferri Pomatum.

Sour apples are boiled with iron filings, and the paste so formed is diluted with water, filtered, and evaporated to dryness. The result is a greenish black substance, containing 5—8 per cent. of iron. *Dose*, 0·1—0·5, in pills. A solution of the extract in *Aqua Cinnamomi Spirituosa*, Pharm. Germ., is called *Tinctura Ferri pomata*, and is given in doses of 10—30 drops.

Iron in combination with malic, citric, and tartaric acids is not precipitated by alkalies. The salts of the oxide formed by these acids less readily throw down albumen than other ferric compounds. They are quickly absorbed by the bowel and the subcutaneous cellular tissue in animals, and soon appear in the urine.

Ferri et Ammoniæ Citras, B.P., U.S., *Ammonio-Citrate of Iron.* An amorphous salt prepared in the form of reddish brown shining plates. It is very soluble and readily deliquesces. It is said to be very digestible, and is much prescribed owing to its comparative tastelessness. *Dose*, gr. v.—xv. Citrate of iron, as such, in moderate doses, has a distinctly diuretic action on animals, and in large doses causes hæmaturia (Kölliker).

Preparation :—

Vinum Ferri Citratis, B.P. (Citrate of iron and ammonia, orange wine ; gr. j. in ʒj. *Dose*, ʒj.—iv.

The U.S. Pharm. also has

Ferri Citras, *Citrate of Iron. Dose*, gr. ii.—v., made by evaporating the *Liquor Ferri Citratis* to dryness. The latter is a solution in citric acid of the precipitate thrown down by ammonia from a solution of tersulphate of iron.

The following combinations are also officinal :—

Ferri et Quiniæ Citras, B.P., U.S. (Contains gr. j. quinine in 6.) *Dose*, gr. j.—x.

Ferri et Strychniæ Citras, U.S. (Contains gr. j. strychnia in 100.) *Dose*, gr. j.—iij.

Ferrum Tartaratum, B.P., Ferri et Potassii Tartras, U.S.

Tartarated Iron. Made by dissolving peroxide of iron in a solution of bitartrate of potash. It at first forms a greyish green, and afterwards a brownish, powder soluble in water. It is said to be less constipating than the other preparations of iron, and is therefore preferred in cases in which it is wished to avoid confining the bowels. Perhaps the peculiar action of the potassium may be also taken into consideration in prescribing it. *Dose*, gr. v.—x. in solution.

Preparation :—

Vinum Ferri, B.P. (Fine iron wire, ℥j., sherry, ℥xx., digested together.) *Dose*, ʒj.—iv.

[The so-called *Vinum Ferri* of the hospitals is generally made with this salt. Tartarated iron generally now appears in commerce in thin reddish scales. The chief objection to its use is its comparative insolubility in water.]

Tartrate of iron was formerly much used in the form of "steel" baths, from 50—100 grammes being added to a bath for an adult; since, however, it has been proved by accurate experiments that not a trace of metals like iron, when brought into contact with the skin under such conditions, passes through it into the blood, the only effect of such a bath would be due to the reflex stimulus of the saline solution.

The U.S. Pharm. has also

Ferri et Ammonii Tartras. Tartrate of Iron and Ammonium. Transparent garnet-red scales, with a sweetish taste. *Dose*, gr. ij.—v.

Another compound containing iron and potassium, the *Potassii Ferrocyanidum*, Pharm. Germ. (FeK_4Cn_6), *Ferrocyanide of Potassium*, may be used as an antidote to certain corrosive metallic salts (sulphate of copper, perchloride of iron), since it forms with them double-cyanides which are insoluble in the secretions of the stomach. When taken into the digestive tract, it is only poisonous if a large quantity of free acid is introduced with it. Enough hydrocyanic acid is then developed to be injurious. It is said to be quickly absorbed owing to its ready solubility, and hence to be well tolerated by the digestive organs. There are, however, other preparations of iron of which this is equally true. *Dose*, gr. x.—xv.

[**Ferri Ferrocyanidum**, U.S., *Ferrocyanide of Iron, Pure Prussian Blue.* A deep blue tasteless powder, prepared by the action of the preceding salt on a solution of tersulphate of iron, is used as a tonic in intermittent fever, neuralgia, &c. *Dose*, gr. ij.—v.].

Besides its tonic effect, tartrate of iron is considered in Germany to have a "resolvent" action, and it is much prescribed in chronic enlargements of the liver and spleen, &c. This reputation is possessed in a still higher degree by *Iron*

Sal Ammoniac, a salt whose name places it among ammonia compounds, but whose action is closely allied to that of the preparations of iron. The latest edition of the German Pharmacopœia entitles it

Ammonium Chloratum Ferratum.

Ammonium Muriaticum Ferruginosum. A crystalline orange-coloured powder, with a harsh pungent taste, readily soluble in water. It is prepared by mixing chloride of ammonium with one-fifth of its weight of solution of perchloride of iron (Fe_2Cl_6). The salt contains about 7 per cent. of chloride of iron, or about 2½ per cent. of pure iron. *Dose*, 0·1—0·5 several times daily, in solution. The only corrective of its flavour is *Extr. Glycyrrhizæ.*

Ferri Sulphas ($FeSO_4$), B.P., U.S.

Sulphate of Iron, Green Vitriol. Crystals of a pale green colour, prepared by dissolving iron wire in dilute sulphuric acid. The Pharmacopœia contains two other forms of the sulphate :—

(1.) *Ferri Sulph. Exsiccata*, B.P., U.S. Made by heating the crystals to 400° Fahr. It is a colourless amorphous substance.

(2.) *Ferri Sulph. Granulata*, B.P. Made by crystallising the sulphate in rectified spirit.

The dried sulphate is best given in pills with a little syrup as an excipient. Small doses of these salts are more readily absorbed, and appear more quickly in the urine than large ones; in doses large enough to have a corrosive action on the intestine, they appear not to be excreted by the urine at all (Schroff).

Sulphate of Iron is used in the preparation of *Ferri Arsenias*, *Ferri Carbonas Saccharata*, and *Mistura Ferri Composita*. *Dose*, of the crystals and the granulated sulphate, gr. j.—iv.; of the dried sulphate, gr. ss.—iij.

The *Liquores Ferri* (*Ter*) *Sulphatis*, B.P., U.S., and *Subsulphatis*, U.S., are only used externally as styptics, or for making other preparations of iron. The U.S. Pharm. also has *Ferri et Ammonii Sulphas*, Ammonio-ferric Alum. *Dose*, gr. j.—ij.

Ferri Phosphas ($Fe_3P_2O_8$), B.P., U.S.

Phosphate of Iron. Insoluble in water. It has been especially recommended in the treatment of rickets. *Dose*, gr. iij.—x.

Preparation :—

Syrupus Ferri Phosphatis, B.P. Contains about 1 grain of phosphate of iron in each drachm. *Dose*, ʒ j.—ij.

Ferri Pyrophosphas, U.S., *Pyrophosphate of Iron with Citrate of Ammonia.* Has a good reputation in Germany for its permanence, solubility, tastelessness, and easy digestibility. It is even injected subcutaneously in pernicious anæmia. It contains 18 per cent. of iron. *Dose*, gr. iij.—viij.

The same is true of the *Pyrophosphate of Iron and Sodium*, Pharm. Germ. *Dose*, gr. v.—xv. half an hour before each meal.

The next drug is largely used, both internally and externally, as a styptic.

Ferri Perchloridum, Ferri Chloridum, U.S. (Fe_2Cl_6).

Crystallised Perchloride of Iron. An orange-yellow substance, which readily deliquesces on exposure to the air. It is used in Germany in the form of *Liquor Ferri Sesquichlorati* (*perchloridi*), which contains 43·5 per cent. of the anhydrous salt. Externally, the perchloride is an excellent astringent to bleeding parts, either diluted with water, in the proportion of about 5·0 grammes : 150·0 aq., or in the pure state. In either case it may be applied on lint, which, however, requires to be firmly pressed down on the part. Its action does not depend on the coagulation of albumen round the mouths of the blood-vessels, but on the contraction which it excites in their muscular coats.

Owing to its caustic properties, which are due to an evolution of chlorine and to indirect oxidation produced by this gas, it must be always used with care, especially for injections. It may be used for such purposes in strengths of from 0·5 and upwards to 150·0 water. The same caution is required in using it as an inhalation with the spray apparatus in hæmorrhage from the lungs. It is doubtful whether it has any effect over bleeding in more distant organs, when introduced by the stomach, though it has a marked action in hæmorrhage from the digestive tract itself, *e.g.*, in typhoid fever and ulcer of the stomach.

[In England, the perchloride is largely used in the form of one of the following preparations as a tonic in albuminuria, erysipelas, and in convalescence from various acute diseases:—

(1.) *Liquor Ferri Perchloridi Fortior*, B.P. Made by dissolving iron wire in dilute hydrochloric acid, and adding nitric acid, heating and evaporating. *Dose*, internally, ♏iij.—x., but it is chiefly used as an external astringent and styptic.

(2.) *Liquor Ferri Perchloridi*, B.P. (Liquor ferri perchlor. fortior, 1 pt., distilled water, 3 pts., sp. gr. 1·105.) *Dose*, ♏x.—xxx. Liquor ferri chloridi, U.S., sp. gr. 1·355. *Dose*, ♏ij.—v.

(3.) *Tinctura Ferri Perchloridi*, B.P.; *Chloridi*, U.S. (Liquor ferri perchlor. fortior, 1 pt., rectified spirit, 3 pts.) *Dose*, ♏x.—xxx.]

Ferri Iodidum (FeI_2).

Iodide of Iron. It is supposed that the iodine in this salt also exerts its special influence, and hence its preparations are in great repute in the treatment of anæmia combined with scrofula in children. As a fact, they are well tolerated, and do good. The iodide of iron is easily oxidised, with the formation of oxide of iron and free iodine. It may thus exercise a corrosive action if given in large doses. In small doses the free iodine may have a beneficial effect on the digestive tract, and since it is there absorbed in one form or another, its introduction into the general system will often be indicated in glandular swellings and other similar conditions.

Claude Bernard states that more iron passes into the animal fluids (as measured by its presence in the urine) during the use of iodide of iron, than during that of any other preparation. Owing to the instability of the iodide as such it is generally used in one of the following forms:—

(1.) *Syrupus Ferri Iodidi.* (One f ʒ contains about 4·3 grs. of crystallised iodide, B.P.; 7½ grs., U.S.) *Dose,* ♏xx.—ʒj.

(2.) *Pilula Ferri Iodidi,* B.P., U.S. (Iron wire, iodine, sugar, licorice root, water; 3 grs. contain 1 gr. of iodide.) *Dose,* gr. iij.—x.

[**Ferri Oxalas,** U.S., *Oxalate of Iron.* A lemon-yellow crystalline powder, insoluble in water, prepared by the action of oxalic acid on sulphate of iron.) *Dose,* gr. ij.—v.

Ferri Pernitras, *Pernitrate of Iron,* is officinal in the form of *Liquor Ferri Pernitratis,* B.P. (*Nitratis*), U.S. (Sp. gr. 1·107, B.P.) *Dose,* ♏x.—xl. (Sp. gr. 1·060—1·070, U.S.) *Dose,* ♏v.—xv. It is sometimes very useful in the chronic diarrhœa of children.

The following drug is indicated in nearly the same conditions as iron:—

Oleum Morrhuæ.

Cod-liver Oil. Prepared from the liver of Gadus Morrhua (Asellus major, true codfish), and other species of the genus Gadus in Norway and Newfoundland. The purest oil is that which simply flows out of the livers when a number of them are heaped up together. It chiefly consists of the glyceride of oleic acid, but also contains the glycerides of palmitic and stearic acids, as well as several volatile fatty acids of disagreeable odour, the constituents of bile, and some compounds of iodine and bromine in addition to the ordinary salts.

In its *action* it resembles most other fats in impairing the digestion if given in large quantities, especially if there is a previous tendency to dyspepsia; yet as far as evidence goes it appears to do less harm than sweet almond oil, the mildest of the other officinal fats. If cod-liver oil is tolerated and assimilated it wonderfully improves the merely vegetative functions of the organism. The primary reason for this is the rapidity with which it is absorbed. This is due (according to O. Naumann) to the presence in it of biliary principles, or (according to Buchheim) to the peculiar behaviour of the free fatty acids. Since the latter combine with the alkalies of the intestinal secretions to form easily soluble soaps, they facilitate the fine subdivision of the glycerides, and hence render their absorption easy, while they are themselves also readily absorbed. Thus, the organism is spared the labour of part of the digestive process, and this must be an important advantage for delicate people with deficient secretion of the digestive juices. Trioleïn (the glyceride of oleic acid) is more readily stored up in the tissues than any other fat; to this circumstance cod-liver oil probably also owes part of its efficacy (Radziejewski). Formerly this was supposed to depend on the presence of salts of iodine, but the amount of them which the oil contains (equivalent to 0·02—0·04 per cent. of the metalloid) is too minute to be of any practical importance.

Use.—Cod-liver oil is given where we wish to improve a general chronic state of mal-nutrition. Where there is gastric derangement, and in [very] young infants, it is contra-indicated, owing to its tendency to produce dyspepsia. It is also generally ill-tolerated in hot summer whether. [It is our most valuable remedy in commencing rickets, and also has a high reputation in the treatment of phthisis.]

Dose.—From a teaspoonful to a tablespoonful twice or three times a day. It is best given floating on some other liquid (black coffee, beer, ginger wine, or even simple water). [It is often tolerated the last thing at night, when it cannot be taken at other times. It is important to commence with small doses, and to increase them gradually so as not to disgust the patient, and it is well to intermit it for a few days occasionally. It is extremely important that the spoon and glass which are used for taking it should be kept *scrupulously clean*, as any oil left adhering to them soon turns rancid.]

The Pharmacopœias also contain the following nourishing and strengthening preparations :—

(1.) **Hordeum Decorticatum**, B.P., U.S. *Pearl Barley.* It consists chiefly of starch with some sugar, gluten, and gum. It is used in the form of *Decoctum Hordei* (1 : 15 water), as a demulcent drink.

(2.) **Amylum**, B.P., U.S. *Ordinary Wheat Starch.* [Used in the following preparations :—

(*a*) *Glycerinum Amyli*, B.P. *Glycerin of Starch.* (Starch, 1 : 8, glycerin.) Made by heating the two ingredients together. Chief use, to apply to chapped or excoriated surfaces.

(*b*) *Mucilago Amyli*, B.P. (Starch, 1 : 40, water.) A vehicle for administering various drugs as enemas : also used for making starch bandages.

(3) **Sago,** U. S., *Sago.* The prepared fecula of the pith of Sagus Rhumphii (Palmæ) and other species of sago.

(4) **Avenæ Farina,** U. S., *Oatmeal.* Prepared from the seed of Avena Sativa (Graminaceæ).]

The German Pharmacopœia also contains:—

Extractum Malti (Bynes), *Malt Extract.* Prepared from barley malt by digestion with water and evaporation. It is yellowish-brown, and has a sweetish taste. It contains a part of the original elements of the barley, some dextrin, and sugar, as well as the bitter, aromatic substances which are produced during the process of malting. When mixed with 2 per cent. of Ferri pyrophosphas cum ammoniæ citrate it forms the *Extractum Malti Ferratum,* Pharm. Germ., a sweet preparation, only slightly astringent in taste, and which can be given in teaspoonful doses several times a day.

Amylum Marantæ, U. S., *Arrowroot.* The starch extracted from the rhizome of Maranta Arundinacea, one of the tropical Scitamineæ. It is characterised by the fineness of its granules. Owing to its easy digestibility, it is an appropriate food in intestinal affections. Of course, it is unsuited for exclusive use, as is too often the case in infantile diarrhœa. Adulterated arrowroot, in great part consisting of the coarse granules of potato starch, is met with in commerce. [Arrowroot is contained in *Trochisci Ipecacuanhæ,* U.S.]

Calcis Phosphas ($Ca_3P_2O_8$), B.P.

Neutral Phosphate of Lime. Prepared by precipitating chloride of calcium with phosphate of soda. Phosphate of lime is of great importance in promoting the growth of the bones, as well as cell formation generally in the system at large. Under certain circumstances it is excreted in excess by the urine, and the nutrition of the body suffers thereby. By administering phosphate of lime it is said that the equilibrium between waste and supply can be re-established. The salt is not readily soluble, but if large quantities of it are continually introduced into the digestive tract the obstacles to its absorption are soon overcome (Riesell, compare page 142). The large quantity of phosphate of lime, which our ordinary food contains, is no objection to its use as a medicine, for otherwise the same argument would hold good of the use of iron in chlorosis. It seems necessary that there should be an excess of both these substances in the intestine to compensate for their deficiency in the tissues.

Use.—Phosphate of lime is given in scrofula, rickets, osteomalacia, and other allied conditions, as a palliative and symptomatic remedy, especially in their early stages. Also empirically in simple hemorrhages from the urinary organs (Stromeyer), though it is not understood in what way it acts. The *dose* is gr. iij.—vi. several times a day, either alone or combined with iron, carbonate of lime, and bitter medicines. In hæmaturia it should be given in doses of 7 or 8 grs. every two hours.

[*Calcii Phosphas Præcipitata*, U.S., is made by precipitating a solution of bone earth, *Os ustum*, in hydrochloric acid by ammonia. *Dose*, gr. x.—xxx. Bone earth is also used for preparing phosphate of soda.]

Phosphorus as such has also been proved by experiments on animals to be under certain circumstances a tissue food.

Phosphorus.

Phosphorus, B.P., U.S. The pure metalloid. Its toxic effects had not supplied any hints which would make it available for therapeutic purposes, and it is only quite recently that the following facts have become known through the careful experiments of G. Wegner:—

Phosphorus exercises a specific *formative action* on osseous tissue, whether it be locally applied in the form of moderately concentrated vapour, or introduced in minute doses into the blood. In the first case, it induces ossifying periostitis, and in the second, it causes the development of compact bone out of soft osteogenous tissue. The cortical substance becomes sclerosed, so as to narrow the Haversian canals, and the medullary cavity of the long bones may be at length completely obliterated by true bone substance. The temporary cartilage of the epiphyses ossifies quicker and more extensively than under normal conditions, and the callus of fractures acquires a more than ordinary solidity. During these processes, if proper caution be used, the phosphorus does not exert any injurious influence whatever, either on the general nutrition or on any individual organ.

Use.—Phosphorus will therefore be indicated in imperfect development of the osseous system in childhood, in fractures (pseudarthroses), subperiosteal excisions and transplantations of the periosteum. There are also grounds for prescribing it in osteomalacia and rickets, although less distinct in the latter disease than in the others just mentioned.

The physiological importance of phosphorus as an element in the construction of important organs such as the brain, the stroma of the red blood corpuscles, &c., renders it conceivable that its influence on the production of bone is not the only application of its therapeutic activity. It also lends support to the older view that phosphorus is of service in certain very severe skin diseases, such as pemphigus, &c. [In leucæmia it has not justified the expectations at first formed of it.]

In administering phosphorus we should begin with very small doses, and gradually increase them. The German Pharmacopœia gives 0·015 gramme as the maximum single dose.

Preparations, B.P.:—

(1.) *Oleum Phosphoratum.* (A solution of phosphorus olive oil; 1 in 160.) *Dose*, ♏v.—x.

(2.) *Pilula Phosphori.* (Phosphorus, balsam of tol yellow wax; 1 in 90). *Dose*, gr. iij.—vj. $=\frac{1}{30}$—$\frac{1}{15}$ of grain.

[Complaints have lately been made of the insolubility phosphorus pills, B.P., in the digestive secretions, the pil passing through the body unaltered. It seems best to subst tute suet for the wax in preparing them (Squire).]

[The following may be regarded to a certain extent as pr parations of phosphorus:—

(1.) *Calcis Hypophosphis*, B.P., U.S. *Dose*, gr. v.—x.

(2.) *Potassii Hypophosphis*, U.S. *Dose*, gr. iij.—x.

(3.) *Sodæ* (*Sodii*) *Hypophosphis*, B.P., U.S. *Dos* gr. v.—x.

There is at present much discussion as to the value of th hypophosphites as medicines. Though largely prescribed i phthisis the opinion of the medical profession does n appear to be at all in favour of their possessing an specific influence over that disease. The writer latel observed a case where gr. iij. Calcis Hypophosph., *bis di* invariably checked the night-sweats.]

CHAPTER VII.

ANTIDYSCRATICA ET ANTISEPTICA.

DIATHETIC AND ANTISEPTIC REMEDIES.

CERTAIN injurious agencies invade our body or develop in it owing to morbid processes, and we are often able to combat them during their protracted action by the aid of certain drugs, although still ignorant of their true nature or constitution.

Quicksilver is the member of this class which is most frequently used. If taken internally for a long period its preparations are liable to produce the following poisonous *symptoms*:—

Inflammatory ulceration of the mucous membrane of the mouth and neighbouring parts, general relaxation of the mucous membranes, phthisis pulmonûm owing to chronic inflammatory changes in the bronchi, diarrhœa, discoloration of the skin, and [very rarely] eruptions on its surface, pains in the limbs, loss of flesh, muscular tremor, mental excitement, paralysis of various groups of muscles, and depression of the cerebral functions. The widespread changes which this metal produces are probably due to its specially poisonous action on the earlier stages of cell-growth, and to the rapid destruction of albumen which it causes in the organism. The albumen of the blood is, however, not attacked by it (von Boeck). In many persons small quantities of mercury promote the formation of fat. This effect is especially marked when the nutrition has previously been impaired by syphilis. According to recent researches (Keyes) mercury in small doses favours the formation of the red blood corpuscles, while in large ones, as might be expected, it hinders it.

Among other secretions the milk of suckling women contains mercury, if the latter be introduced into the system by the mouth (Lewald). The pharmaceutical name of the metal is

Hydrargyrum (Hg).

Quicksilver. The pure metal is sometimes given in volvulus and intussusception of the small intestine. The dose is 200 grammes or more. It is, however, questionable whether the mass always passes in a compact form through the bowel, and does not spread itself in a finely divided state over the intestinal mucous membrane, and also whether its pressure is always exerted in the desired direction. If the mass of quicksilver remains in the stomach it may by its pressure excite more vigorous reflex peristaltic movements in the bowel, and hence enable the latter to overcome certain mechanical obstacles (Traube).

Metallic mercury is also given internally in the form of the following preparations:—

(1.) *Pilula Hydrargyri*, Blue Pill, B.P., U.S. (Mercury, confection of roses, powdered liquorice root; 1 in 3.) *Dose*, gr. iij.—vj., as an alterative; gr. x.—xv., as a purgative.

(2.) *Hydrargyrum cum Cretâ*, Grey Powder. (Mercury, 1 pt., prepared chalk, 2 pts.; strength, 1 in 3, B.P.; 3 in 5, U.S.) *Dose*, gr. iij.—viij., B.P.; gr. v.—ʒ ss., U.S.

(3.) *Suppositoria Hydrargyri*, B.P. (5 grains in each.)

The following preparations contain the mercury in a finely divided state obtained by triturating it with various oily substances:—

(1.) *Unguentum Hydrargyri*, B.P., U.S., Mercurial Ointment. (Mercury, lard, suet; 1 in 2.) The metal is present partly as minute globules, and partly as an oxide and suboxide combined with fatty acids. It is absorbed into the system by solution in the secretions of the skin, among which the chloride of sodium is especially active.

(2.) *Unguentum Hydrargyri Compositum*, B.P. (The above with wax, olive oil, and camphor.)

(3.) *Linimentum Hydrargyri*, B.P. (Mercury ointment, with liquor ammoniæ, and camphor liniment; 1 in 6.)

Use.—(1.) In inflammations of most serous membranes, as well as of the parenchyma of various organs.

It is precisely in this form that, owing to the direct effect of the mercury upon impending or slightly developed suppuration, we may often expect a successful therapeutic result. If, as occasionally happens, the inunction of mercurial ointment increases the painfulness of the inflamed parts, the ointment has probably been made with rancid fat.

(2.) In secondary syphilis in the form of inunction.

Some authorities have disputed the necessity of the use of mercury in general, and of the ointment in particular, in the above disease. They have contended that thereby the syphilitic poison is only rendered latent and not destroyed, and that the poisonous metal may possibly give rise by its presence to still more serious complications. Now, although these objections have certainly been carried too far, it still seems advisable not to administer either this or any other preparation of mercury too freely, and whenever it is possible to make a previous trial of less powerful measures.

According to Kirchgässer, the salivation and inflammation of the mouth which so often accompany the inunction cure depend on the inhalation and local action of the volatilised metal. Good ventilation, and protection of the anointed parts with some impermeable material, prevent these unpleasant effects. In any case we must not under-estimate this local influence of the metal, although it is not the only one on which the stomatitis and salivation probably depend. Both symptoms can be alleviated or removed by chlorate of potash.

(3.) To destroy animal and vegetable parasites upon the skin.

Dose.—As an antiphlogistic the ointment is rubbed several times a day into the neighbourhood of the inflamed parts in pieces the size of a pea or bean, either alone or combined with narcotic remedies. In syphilis ʒ ss—j. is rubbed in every other day. [In infantile syphilis, a piece the size of a small pea should be rubbed into the sole of each foot alternately every day.]

Metallic mercury also is the chief ingredient in

(1.) *Emplastrum Hydrargyri.* (Mercury, olive oil, sublimed sulphur, lead plaster, B.P.; same without sulphur, U.S.; strength in both 1 in $3\frac{2}{3}$.)

(2.) *Emplastrum Ammoniaci cum Hydrargyro*, B.P., U.S. (Ammoniacum, mercury, olive oil, sulphur; 1 in 5.)

The *Emplastra* are considered to have a powerful resolvent action, not only in simple inflammations, but also in syphilitic ulcers and enlargements. Quicksilver could be detected in the urine after a large plaster had been hermetically applied to the skin (Röhrig).

Hydrargyri Oxidum Rubrum (HgO).

Red Oxide of Mercury, B.P., U.S. Prepared by dissolving the metal in dilute nitric acid, evaporating to dryness, and triturating the residue with a further quantity of metallic mercury, and heating until acid vapours cease to be evolved. It was formerly supposed to have a specific action on inveterate forms of syphilis. It is now rarely used except externally, as,—

Unguentum Hydrargyri Oxidi Rubri, B.P., U. S. (1 : 7 pts. yellow wax and almond oil, B.P.; simple ointment, U.S. A good application to suppurating ulcers. Owing to its excellent effect on certain inflammations of the outer parts of the eye, the ancients called it *Balsamum Ophthalmicum Rubrum.* For ophthalmic purposes the German Pharmacopœia orders a dilute ointment (1 : 19 wax, and 30 almond oil), but many surgeons prefer the oxide made in the wet way, by precipitating perchloride of mercury by caustic soda for this purpose, viz. :—

Hydrargyri Oxidum Flavum, B.P., U.S.

Yellow Oxide of Mercury. It more readily enters into combination with other substances than the red oxide, and hence has a more powerful action. It is officinal as an ointment in the United States (1 : 7, simple ointment).

Hydrargyri Iodidum Viride (HgI), B.P., U.S.

Green Iodide of Mercury. A greenish powder, made by triturating iodine and mercury together in a mortar. An antisyphilitic remedy, much prescribed in doses of gr. j.—iij. This combination was formerly considered specially curative, owing to Ricord's recommendation.

The **Hydrargyri Iodidum Rubrum** (HgI_2), B.P., U.S., *Red Iodide of Mercury*, has powerful caustic properties, and should be avoided. Its *dose* is gr. $\frac{1}{16}$—$\frac{1}{4}$. [Best given in a solution of iodide of potassium (Squire).]

Preparation :—

Unguentum Hydrargyri Iodidi Rubri, U.S. (gr. xvj. : ℥j., simple ointment.)

Hydrargyri Perchloridum, B.P. **Hydrargyri Chloridum Corrosivum**, U.S. ($HgCl_2$).

Corrosive Sublimate, Bichloride of Mercury. The only officinal preparation of mercury given internally, which is soluble in water (1 : 16). Many medical men regard it as a specially useful antisyphilitic preparation. Its *dose* is gr. $\frac{1}{16}$—$\frac{1}{8}$ twice or three times a day. Opinions are divided as to its value in syphilis. Corrosive sublimate, when given in pills, less readily causes salivation than any other preparation, probably because only minute quantities of the metal are absorbed into the system at one time. For the same reason, however, the phenomena of syphilis disappear under its influence more slowly than when other preparations are used (von Bärensprung). On the other hand, patients who are affected with other blood disorders, such as intermittent fever and scurvy, are said to tolerate it better than any other mercurial compound (Sigmund).

The antiseptic and antizymotic action of perchloride of mercury upon organic bodies and organic mixtures is one of the most powerful we know of, but further evidence is needed to determine whether, and to what extent, this property can be utilised in the treatment of the corresponding forms of disease in the human organism. It has been often recommended in febrile diseases, and especially in acute rheumatism. [According to Rutherford and Vignal, corrosive sublimate is a powerful cholagogue, with scarcely any action on the intestinal glands.]

Form of Administration.—In Germany it is usually given in pills with some simple vegetable excipient. Since it is not absorbed to a useful extent if diarrhœa be present, and since it appears to be more readily absorbed if there is slight constipation, a little opium is often added to the pills, about 0·2 to 100 pills, each of which contains 0·005 of the perchloride. The maximum dose is 0·03, *i.e.*, six pills at one time.

Preparations :—

(1.) *Liquor Hydrargyri Perchloridi*, B.P. (Perchloride of mercury, chloride of ammonium, distilled water. Strength, gr. $\frac{1}{16}$ in f ʒ j.) *Dose*, ♏xxx.—ʒ ij.

(2.) *Lotio Hydrargyri Flavi*, B.P. (Perchloride of mercury, lime water; 1 in 266.)

In England, the solution of the perchloride is generally preferred to the solid form. One fluid drachm,=gr. $\frac{1}{16}$, twice a day is an average dose.

Bamberger has recommended a good formula for a solution for subcutaneous injection. It is founded on the fact, that a solution of albumen when treated with corrosive sublimate forms a precipitate of albuminate of mercury, which can be redissolved by a solution of chloride of sodium so as to form a clear solution. The following is the formula for its preparation; 30 cubic centimetres of white of egg are dissolved in 50 grammes of water, and filtered till perfectly clear; at the same time a solution of 1·0 gramme corrosive sublimate in 19 grammes of water is prepared. The solution of albumen is then gradually added to the latter, the whole being constantly shaken, until all the metal is combined with albumen, that is to say, until a drop of the mixture no longer gives a reddish precipitate with a little soda solution. Four grammes of chloride of sodium are now dissolved in 16·0 of water, and added to the albuminate until the precipitate is completely dissolved. The whole is then diluted to a volume of 100 cubic centimetres by adding distilled water, and allowed to stand in the cool several days. It is then filtered and kept in the dark in a cold place. Its use causes scarcely any irritation, and it acts rapidly without causing salivation.

According to more recent statements a solution of peptone is preferable to one of albumen for preparing the mercurial injection, since it is more readily absorbed.

Corrosive sublimate has been used externally in the form of baths (especially in syphilitic eruptions), injections, compresses, lotions, and ointments. Since it is absorbed when mechanically rubbed into the skin as an ointment, its use in this form may be followed, as in reported cases, by poisonous symptoms. The latter are also stated to occur if it be applied as a lotion to large surfaces of excoriated skin, as well as if the powdered sublimate is sprinkled on ulcers.

Hydrargyri Subchloridum (HgCl).

Hydrargyri Chloridum Mite, U.S., *Calomel*, *Subchloride of Mercury*. Obtained by subliming a mixture of perchloride of mercury and metallic mercury, and afterwards powdering and washing; also by subliming a mixture of sulphate of mercury, mercury, and chloride of sodium with steam, in which case its granules have a finer texture, and its action consequently is more rapid.

Calomel is insoluble in the hydrochloric acid of the gastric juice, but if brought into contact with a solution of albumen for a little while at the temperature of the body, a portion of the metal always becomes dissolved in the latter, and can be detected by proper reagents (Buchheim). In the same way the urine always contains mercury after calomel has been repeatedly dusted into the eye (Kämmerer). According to the researches of Voit, all the salts of mercury which are absorbed into the system, are converted by the chloride of sodium (and the carbonic acid) into soluble combinations. This change is a direct one in the case of the salts of the oxides, whereas the salts of the suboxide require the assistance of oxygen to effect it. On the other hand, when corrosive sublimate is dissolved in an excess of albumen and digested at the temperature of the blood it is reconverted into a salt of the suboxide.

Action.—Calomel in small doses affects the system at large like all other mercurial preparations. In doses of the strength most commonly used it quickly excites stomatitis and salivation. In adults, doses of from gr. ivss.—viiss. excite violent peristaltic movements of the bowel, and often produce profuse diarrhœa. It is not unfrequently vomited, most probably owing to the formation of corrosive sublimate in the stomach in the presence of albumen.

According to extensive recent researches the quantity of bile secreted by the liver is not absolutely increased by the action of calomel, but, on the contrary, somewhat diminished by its prolonged administration. The dark green colour of the abundant motions which it produces is due to the rapid descent of the bile from the upper part of the intestinal canal. On the other hand, it has been proved, and most recently by Radziejewski's researches, that calomel stimulates the functions of the pancreas, large quantities of leucin, tyrosin, and indol, being found in the fæces after its use, whereas, they are absent in diarrhœa caused by other drastic purgatives. [Calomel also powerfully excites the secretion of the intestinal glands (Rutherford and Vignal).]

If we accept Schiff's researches, which show that the liver not only *secretes* bile but also *excretes* that which has already been secreted and absorbed in the intestine, we can explain the fact that less bile enters the duodenum after diarrhœa induced by calomel. This diminution will also be explicable by the necessarily more rapid removal of the chyme, for with impaired nutrition less bile is secreted. In this sense we may say that calomel relieves the animal juices of any excess of biliary principles which they may contain, and hence it may still be called a cholagogue, although the term has quite another meaning to its former one (Brunton).

Generally speaking, the secretion of bile is transitorily increased by all causes which excite hyperæmia of the bowel.

The action of calomel varies very much with the quantity prescribed, and the occasion for its therapeutic.

Use.—It is still sometimes given (1) in inflammations of the mucous membranes, and of the substance of organs, whether of traumatic or idiopathic origin. The dose is then 0·01 —0·1 (gr. $\frac{1}{6}$—iss.) several times a day.

Preparation :—

Pilula Hydrargyri Subchloridi Composita, B.P. (Calomel, sulphurated antimony, guaiac resin, castor oil ; 1 in 5.) *Dose*, gr. v.—x. *Pilulæ Antimonii Comp.*, U.S. (Same ingredients; 1 in 6.) *Dose*, 1 to 2 pills.

Here the effect is most probably chiefly referable to a reduction of abnormal temperature by the calomel. With regard to this point, we possess fairly accurate observations which have been made *inter alia* upon typhoid fever, and especially upon pneumonia (Traube). The simultaneous use of other antipyretics is not contra-indicated.

(2.) In all forms of secondary syphilis in doses of 0·025—0·05 (gr. $\frac{3}{8}$—$\frac{3}{4}$) twice or three times a day. [Also externally as a fumigation every day, or second day. *Dose*, gr. xx., heated in a proper apparatus.]

Here the rule seems to be that while the mouth becomes quickly inflamed, syphilitic symptoms rapidly improve. The simultaneous use of chlorate of potash materially relieves stomatitis.

(3.) In the commencement of typhoid fever, with a view to cut short the disease, in a single dose of from 0·4—1·0 (gr. vj.—xv.), or in doses of 0·2—0·4 (gr. iij.—vj.) every two hours, several times repeated (Wunderlich).

It should only be tried at the beginning of the disease, and in cases in which there is no severe diarrhœa. Its effect is most probably due to a local weakening or destruction of the typhoid poison in the bowel and the mesenteric glands, owing to the conversion of a part of the calomel into the powerfully antiseptic sublimate. The same explanation holds good for its next indication, in which we have to assume the presence of abnormal ferments.

(4.) As a styptic in diarrhœa, especially that which attacks children during the hot season. The dose must be a small one, from 0·005—0·02.

(5.) As a purgative, with the view of simultaneously exerting a so-called "derivative" effect on the intestine. Here a single dose of 0·05—0·5 or more may be given, or several such consecutive doses.

Large doses of calomel, which are intended to purge but fail to do so, may cause salivation; hence it is usual to order some vegetable aperient either with or soon after the former. Children appear to be but little liable to salivation while taking calomel.

(6.) As a local stimulant in phlyctenular ophthalmia. (*Vide* als. *Cauteria.*)

[The U.S. Pharm. also has :—

Hydrargyri Cyanidum ($Hg.(CN)_2$), *Bicyanide of Mercury.* It forms white, prismatic crystals, wholly soluble in water. Made into pills with milk sugar it is valuable in the early stages of syphilis. *Dose*, gr. $\frac{1}{20}$—$\frac{1}{6}$, twice or three times a-day.]

Hydrargyri Sulphuratum Rubrum (HgS), *Cinnabar.* Chiefly used for fumigations in inveterate cases of cutaneous syphilis. When heated it decomposes with the formation of mercury vapour and sulphurous acid gas. *Dose*, for one fumigation, gr. xxx.—lx.

The other preparations of mercury are only used externally (Cf. Cauteria).

The following drug is said to resemble mercury in its therapeutic properties :—

Auri et Sodii Chloridum, PHARM. GERM. ($AuCl_3,4NaCl$).

Chloride of Gold and Sodium. Made by dissolving gold in *aqua regia*, and crystallising with chloride of sodium. It is a moist yellow powder, which contains 50 per cent. of terchloride of gold. It has caustic properties. It was formerly used in syphilis; at present it is occasionally given in various neuroses, and particularly in hysteria (Niemeyer); perhaps because (according to Nöggerath) it quickly cures chronic ovaritis, if the latter be uncomplicated with other organic mischief. Its dose is 0·01—0·06 (!) several times a day, and only in the form of pills.

The next drug has many therapeutic relations with quicksilver.

Iodum, B.P., **Iodinium,** U.S. (I).

Pure Iodine. A metalloid of well-known physical properties. It is very slightly soluble in water, but readily in alcohol and æther. Externally applied it has a caustic action, and coagulates albumen; hence, if introduced into the stomach in large doses it impairs digestion, just like chlorine and bromine. It also has the same antiseptic properties as they have, and it is a powerful poison to the lowest kinds of organisms.

Its use is often accompanied by violent catarrh of the nasal and pharyngeal mucous membranes, as well as by irritation of the salivary glands, and if long continued, the condition known as *iodism* develops. It is characterised, like most forms of chronic metallic poisoning, by eruptions on the skin (acne), hyperæmia of the mucous membranes, headache, and trembling of the limbs. If given in excessive doses, iodine destroys life by direct paralysis of the heart and respiration.

The following preparations are officinal:—

(1.) *Linimentum Iodi*, B.P. (Iodine, iodide of potassium, camphor, rectified spirit; strength, 1 in 9.)

(2.) *Liquor Iodi*, B.P.; *Iodinii Co.*, U.S. (Iodine, iodide of potassium, distilled water; 1 in 24, B.P.; 1 in 20, U.S.)

(3.) *Vapor Iodi*, B.P. (Tincture of iodine, ʒj., water, ℥j.) The vapour is to be inhaled from a porcelain inhaler, gently heated.

(4.) *Tinctura Iodi*, B.P. (Iodine, iodide of potassium, rectified spirit; 1 in 40.) *Dose*, ♏v.—xx. The *Tinctura Iodinii*, U.S. (1 in 17), contains no iodide of potassium. *Dose*, ♏j.—v.

(5.) *Tinctura Iodinii Composita*, U.S. (Iodine, ℥ss., iodide of potassium, ℥j., alcohol, Oj.) *Dose*, ♏ij.—x.

(6.) *Unguentum Iodi*, B.P. (Iodine, iodide of potassium, proof spirit, prepared lard; 1 in 31.) The *Unguentum Iodinii*, U.S., contains iodine, 20 pts., iodide of potassium, 4, water, 6, lard, 480.

(7.) *Unguentum Iodinii Compositum*, U.S. (Iodine, 15 pts., iodide of potassium, 30, water, 30, lard, 480.)

The *Tinctura Iodi*, when applied to the epidermis several times in succession, causes irritation, which extends into the corium, and is followed by shrivelling and exfoliation of the uppermost layers of the epidermis. It is absolutely certain that iodine can be absorbed into the system through the skin when thus applied. [The *Linimentum Iodi*, B.P., is a much stronger preparation, and requires to be used with caution, as one or two applications of it will sometimes blister, especially in children and adults with delicate skins.]

Use.—Tincture of iodine is occasionally given empirically with good effect in cases of gastralgia and vomiting, whether an organic cause for them can be detected or not; [also in secondary and tertiary syphilis (Zeissl).] Externally, it is much used as a paint to produce absorption of the most various pathological products, both liquid and solid, and it is injected into fistulæ, cysts, and hydroceles, with a view to set up inflammation in them, and produce contraction or obliteration of their cavities. In using it for this purpose, we must not forget how readily iodine is absorbed by such parts, and how poisonous it is in large doses.

A few hours after the skin has been painted with a strong solution of iodine a considerable transudation of serum occurs into the subcutaneous cellular tissues, accompanied by an accumulation of white blood corpuscles in it, as well as in the corium, the intermuscular tissues, and those parts of the bones which lie nearest to the periosteum. About a week later retrograde changes begin to be distinctly marked. Both the white blood cells and the tissues, in which they are accumulated in large quantities, undergo fatty degeneration, and are completely removed. Their absorption is due to the artificial erysipelas produced by the iodine (Schede), and must, from all we know of the vital action of the protoplasm of the white blood corpuscles, be regarded as a consequence of active oxidation initiated by these cells.

Potassii Iodidum (KI), B.P., U.S.

Iodide of Potassium. A salt which is soluble in equal parts of water [more accurately 4 pts. in 3 pts. water]. Therapeutists are generally agreed that it possesses the power of promoting absorption, although we shall only have a clear idea of its intimate relations with the animal functions, when we understand the actual nature of the disturbances which it is found by experience to be successful in combating. Its behaviour in the presence of protoplasm, carbonic acid, and water, offers us a starting point for the general comprehension of the internal action of this otherwise indifferent salt. It is then converted into bicarbonate or potash and free iodine; the necessary consequence of this reaction being a further alteration in the arrangement of the molecules of the albuminous substance. Certain combinations of cells appear to exhibit a particularly strong affinity for iodine.

The only morbid conditions which result even from its long-continued use are the well-known catarrh of the nose and pharynx. Occasionally it produces general emaciation.

It very rapidly appears in the urine. An aqueous solution of it is not absorbed by the unbroken skin any more than that of any other non-volatile salt. It appears, however, to be absorbed if applied to the skin in the form of a fine spray (Rōhrig).

Use.—Internally. (1.) Wherever we desire to cause the absorption of morbid products. There is no such condition in which iodide of potassium has not been recommended, but it is specially used in the treatment of rheumatic and scrofulous deposits.

(2.) In all forms of so-called tertiary syphilis, and generally with immediate effect. It also improves the remittent fever which accompanies them (Bäumler). It is inferior to iodide of potassium as a remedy in the earlier stages of syphilis.

(3.) In chronic poisoning by metals, especially mercury. It is supposed on experimental grounds that the iodine causes a more rapid excretion of mercury, especially by the urine. The albuminate of chloride of mercury is readily soluble in iodide of potassium. The latter forms, with the soluble salts of mercury, a sub-iodide, or iodide, of mercury, which is again dissolved by an excess of KI. Its use in lead poisoning (Melsens) is founded on similar views.

Externally it is used as *Unguentum Potassii Iodidi* (1 in 8¾, B.P.; 1 in 8, U.S.) for the purposes named in paragraph (1); but its absorption through the skin can only occur when decomposed by the cutaneous secretions. Occasionally some pure iodine is added to the ointment to increase its action (about 0·5 iodine to 20·0 ungt. pot. iod.). Iodide of potassium is also used to make pure iodine more soluble in water. Such a mixture prepared of various strengths is called *Lugol's Iodine Solution*, and is generally used as a stimulating and resolvent injection, for example in thyroid enlargements, [and hydrocele].

The *Linimentum Pot. Iodidi cum Sapone*, B.P. (hard soap, iodide of potassium, glycerin, oil of lemon, water), is used in enlargement of the joints, and in glandular swellings. It does not irritate the skin.

Ammonii Iodidum (NH_4I), U.S., *Iodide of Ammonium*, resembles iodide of potassium in its action, but is said to be more active. *Dose*, gr. ij.—x.

Plumbi Iodidum (PBI_2), B.P., *Iodide of Lead.* A yellowish powder only used externally as an application to buboes, inflamed testicles, benign tumours, &c., in the following forms.

(1.) *Unguentum Plumbi Iodidi*, B.P., U.S. (Iodide of lead, simple ointment; 1 in 8.)

(2.) *Emplastrum Plumbi Iodidi*, B.P. (Iodide of lead, soap plaster, resin plaster; 1 in 9.)

The same remarks apply to the

Sulphuris Iodidum (I_2S), *Iodide of Sulphur*, which has the advantage of being more readily decomposed. It is chiefly used in [acne and sycosis, and other] chronic eruptions of the skin, in the form of *Unguentum Sulphuris Iodidi*, B.P., U.S. (Iodide of sulphur, lard; 1 : 16).

The following preparations are frequently used in conjunction with mercury and iodine as specifics in the treatment of syphilis.

Sarsæ Radix.

Sarsaparilla root. Obtained from several species of the genus Smilax, a climbing plant from Central America. It is at present uncertain whether the crystalline Smilacin, a body with the characters of a glucoside, which it contains, is its active principle or not, as we have no experimental proof that such is the case. Pure smilacin in doses not exceeding one gramme, produced in the digestive tract the symptoms common to most acrid substances. Hence the use of sarsaparilla is based upon purely empirical observations.

It is prescribed: (1.) In constitutional syphilis; (2.) in mercurial poisoning; (3.) in chronic rheumatism and gout, as well as in other general cachectic conditions.

The preparations of Sarsaparilla, Pharm. Germ., are as follows :—

(1.) *Decoctum Sarsaparillæ Compositum Fortius, Zittmann's Decoction* (without mercury). An infusion and decoction of sarsaparilla, senna leaves, liquorice root, and anise and fennel seeds, in which a little alum and white sugar are dissolved. It is always administered with

(2.) *Decoctum Sarsaparillæ Compositum Mitius.* A decoction, and infusion of the residue left in making the stronger decoction, with the addition of half the previous quantity of sarsaparilla, and of small quantities of lemon peel, cinnamon, cardamoms, and liquorice root. Both decoctions are administered somewhat in the following way.

As many jugs of both decoctions are ordered, as the cure is to last days. Each jug containing from 1—1½ kilogrammes (two to three pints).

The Decoctum Fortius is labelled No. I., the Decoctum Mitius, No. II. In the morning a jug of No. I. is brought in a vessel of hot water to the patient's bedside, and he drinks it gradually in the course of an hour. After he has perspired sufficiently, he gets up and waits till his bowels are moved by the decoction, which generally happens after he has had a light breakfast. About three o'clock in the afternoon he has a second meal, and at five o'clock he returns to bed, and drinks a jug of No. II. This second dose is generally followed by copious perspiration, but the action of the bowels is less than in the morning. The patient then remains in bed until the following day.

In spite of our ignorance whether sarsaparilla has specific properties or not, it is impossible to deny that very satisfactory results are obtained by Zittmann's cure. It is also said to be useful in recent cases of lupus in strong subjects. Probably, part of its effect is due to the aperient senna and the diaphoretic æthereal oils which it contains; and the withdrawal of solid food and increased activity of the excretory organs cannot fail to exert some influence on any *materia peccans* which may be present in the system. Hence the old formula has been rightly retained in spite of its prolixity, especially as experience proves that neither the stomach nor the bowels are at all permanently injured by the somewhat severe strain on them, which this treatment involves.

It was formerly the custom to hang a small bag of calomel and cinnabar in the *Decoctum fortius* during its preparation. By this means, some perchloride of mercury was formed, and remained in solution. The addition of mercurial preparations in unknown proportion to a preparation which is intended as a direct substitute for mercury, is still made by the German druggist when "*Decoctum Zittmanni*" is prescribed. [To this possibly are due some of the cures which are ascribed to the sarsaparilla.]

The following preparations of sarsaparilla are officinal :—

(1.) *Decoctum Sarsæ*, B.P. (Sarsaparilla, distilled water; 1 in 8.) *Dose*, Oss.—j., daily in divided doses.

(1.) *Decoctum Sarsæ* (*Sarsaparillæ*) *Compositum*. (Sarsaparilla, sassafras, guaiacum, liquorice root, mezereon, water;

1 in 8, B.P., U.S.) *Dose*, same as *Decoctum*, B.P.; ℥ iv., U.S.

(3.) *Extractum Sarsæ Liquidum*, B.P. (Sarsaparilla, distilled water, rectified spirit. Its specific gravity should be about 1·095; strength, 2 pts. of the root in 1.) *Dose*, ʒ j.—iv.

(4.) *Extractum Sarsaparillæ Fluidum*, U.S. (Sarsaparilla, alcohol, glycerin; 1 in 1.) *Dose*, ♏xxx.—lx.

(5.) *Extractum Sarsaparillæ Compositum Fluidum*, U.S. (Sarsaparilla, liquorice root, sassafras, mezereon, glycerin, diluted alcohol; 1 in 1.) *Dose*, ʒ ss.—ij.

(6.) *Syrupus Sarsaparillæ Compositus*, U.S. (Sarsaparilla, guaiacum wood, pale rose, senna, liquorice, oil of sassafras, oil of anise, oil of gaultheria, syrup, diluted alcohol.) *Dose*, ʒ j.—℥ ss.

Lignum Guaiaci.

The wood of Guaiacum Officinale (Rutaceæ), a tree from the West Indian Islands. It formerly had a great reputation in syphilis, but is now chiefly used in chronic rheumatism and gout, especially the former, and usually as one of the following preparations:—

(1.) **Guaiaci Resina**, B.P., U.S. The resin which exudes from the wood, either naturally or after incision. When powdered, it is distinguished from other resins by its property of readily absorbing oxygen from the air when exposed to the light, and thus acquiring a bluish-green tint. If given alone, the *dose* is gr. x.—xxx., three or four times a day, but it is usually prescribed either as

(2.) *Mistura Guaiaci*, B.P., with sugar, gum arabic, and cinnamon water, of which the *dose* is ℥ ss.—j., or as

(3.) *Tinctura Guaiaci Ammoniata*, B.P., U.S. (Dissolved in aromatic spirit of ammonia; 1 in 5.) *Dose*, ʒ ss.—ij., suspended in mucilage. [An empirical remedy in acute tonsillitis.]

Preparation of the wood:—

Tinctura Guaiaci, U.S. (Guaiacum, alcohol; 1 in 5.) *Dose*, ʒ j.—iij. [A little of the tincture mixed with ozonic æther (æther containing peroxide of hydrogen), gives a sapphire-blue colour to urine, or other liquids, in which traces of blood are present.]

Guaiacum wood acquired its historical reputation through Ulrich von Hutten. After he had been cured of syphilis by its use, he described both the disease and its remedy in a treatise, "De Guaiaci medicinâ et morbo Gallico. Moguntiæ, 1519," dedicated to the Archbishop Albert of Mayence.

Sassafras Radix, B.P., U.S. The wood of the root of Sassafras Officinale (Lauraceæ), a shrub, native of the eastern part of North America. It contains resin and an æthereal oil. It is occasionally added to diuretic and diaphoretic mixtures. [In England it is only prescribed in the form of *Decoctum Sarsæ Compositum.* The U.S. Pharm. orders the root bark, which is stronger than the root.]

We have still less scientific acquaintance with the following drug than with the preceding:—

Capsici Fructus, *Spanish Pepper.* The fruit of Capsicum fastigiatum and Capsicum annuum (Solanaceæ), from the East and West Indies. A brownish-red oily liquid can be isolated from the fruit, which has an excessively sharp taste, and excites violent burning pain and inflammation when applied to the skin (Buchheim). Many authorities state that capsicum irritates the kidneys, and increases their secretions. It was formerly used in many diseases as a so-called "blood purifier," and among others in chronic rheumatism. For this purpose it is now quite obsolete. It was given in doses of from gr. ss.—iv. in pills. Its officinal preparations are:—

(1.) *Tinctura Capsici.* (Capsicum, *rectified* spirit; 1 in

27, B.P.; *proof* spirit; 1 in 32, U.S.) *Dose*, ♏x.—xx., B.P.; ʒj.—ij., U.S. It may possibly be of some slight use for the purposes above named. It has been also recommended in delirium tremens (Hermann). It is sometimes used externally as an ingredient of hair washes, also [as a counter irritant, *e.g.*, in lumbago, as a stimulant to chilblains, and as an addition to gargles (ʒj. in ℥x. water).

(2.) *Infusum Capsici*, U.S. (1 in 16). *Dose*, ℥ss.

(3.) *Oleoresina Capsici*, U.S. (An æthereal extract.) *Dose*, ♏j.—v.

Acidum Arseniosum, (As_2O_3).

Arsenious Acid. Chiefly used to prepare the following drug.

Liquor Arsenicalis, B.P. (K_3AsO_3).

Liquor Potassii Arsenitis, U.S., *Fowler's Arsenical Solution.* Arsenious acid (white arsenic) is only slightly soluble in water, but dissolves more readily in alkalies with which it forms salts. [Fowler's solution contains arsenious acid, carbonate of potash, compound tincture of lavender, and distilled water. Its strength is 1 gr. in 2 drachms. *Dose*, ♏ij—viij. twice or three times a day directly after meals. It is best to begin with a dose of three or four minims, and gradually to increase the amount of each dose until a perceptible effect is produced upon the disease, or slight symptoms of arsenical poisoning are observed. Toleration of the drug varies much with the individual, and in some cases as much as 10 or 15 minims may be given at one dose. Children tolerate arsenic relatively better than adults, and a child of five years old (Duhring) has even taken doses of 20 minims with advantage.]

Action.—Administered in very small quantities, and with attention to certain precautions, arsenious acid has the power of aiding the deposit of fat in the tissues of the body, as is proved by the arsenic eaters of the Styrian Alps, and by its effect upon horses. If given for some time in moderate doses it often causes pain and oppression in the stomach, dyspepsia, a sensation of burning in the eyelids, [cramps in the legs], and finally, general cachexia. Larger doses have a very poisonous action upon all parts of the organism; but many points connected with their poisonous properties are still unexplained. The most prominent symptoms are the paralysis of the heart and the condition of the intestine. The latter, whether the drug be introduced by the mouth or by the skin, assumes the form of a paralytic inflammation of the whole mucous membrane, and closely resembles the condition which exists in purulent infection and Asiatic cholera. The local effect of arsenic as a caustic seems to be very slight.

If a frog be poisoned with arsenic, its peripheral nerves and its muscles remain irritable, while it loses its sensibility. The effect is the same if the afferent blood-vessels are ligatured, and hence is due to some influence exerted by the arsenic on the spinal cord, or to speak more accurately, on its grey matter (Sklarek). Arsenic has a similar action on warm-blooded animals.

In rabbits which had taken arsenic for several days, diabetes did not occur, either after Cl. Bernard's operation, or after poisoning with curare. Even before the arsenic induced fatty degeneration of the liver there was a diminution, and then a disappearance of glycogen, nor did the latter reappear, when the administration of the arsenic was continued, and the fat which had been deposited again, as is ordinarily the case, disappeared (Salkowski).

Arsenic either checks or prevents the decomposition of albuminous substances, and also arrests such fermentative processes as are due to *organized* ferments. The officinal solution of arsenite of potash only differs from the uncombined acid in its less powerful action.

Use.—(1.) In all non-parasitic, chronic skin eruptions, with the exception of lupus and ichthyosis [but especially in eczema, psoriasis, and recurrent pemphigus (Hutchinson).]

(2.) It has been given with striking effect in several cases of malignant lymphomata (Billroth, Czerny).

(3.) In intermittent fever, in which it has been specially recommended by the French physicians.

(4.) In neuralgia and other neurotic conditions, both with typical and atypical course; in many cases of this kind, its effect is remarkable when all other remedies have failed [*e.g.*, in the after-pains of Herpes Zoster].

(5.) In diabetes (Leube.)

(6.) In chronic trembling, administered subcutaneously several times a day for a long period, in 0·15 doses of Fowler's solution, Pharm. Germ. (Eulenburg). N.B.—The officinal solution, Pharm. Germ., contains 1 pt. of arsenious acid in 90.

The other arsenical preparations contained in the British and U.S. Pharmacopœias are the following:—

(1.) *Liquor Arsenici Hydrochloricus*, B.P., *Arsenici Chloridi*, U.S. (Arsenious acid, hydrochloric acid, distilled water; 1 in 120.) *Dose*, ♏ij.—viij.

(2.) *Liquor Sodæ (Sodii) Arseniatis*, B.P.,U.S. (Arseniate of soda, gr. iv., distilled water, ℥j.; 1 in 120.) *Dose*, ♏v.—x.

(3.) *Sodæ (Sodii) Arsenias*, B.P., U.S. (Arseniate of Soda.) *Dose*, gr. $\frac{1}{16}$—$\frac{1}{8}$.

(4.) *Ferri Arsenias*, B.P. (Arseniate of iron, an amorphous green powder.) *Dose*, gr. $\frac{1}{16}$—$\frac{1}{2}$ in a pill.

(5.) *Arsenici Iodidum*, U.S. (An orange-red crystalline solid made by heating together gr. lx. arsenic, with gr. ccc. iodine). *Dose*, gr. $\frac{1}{20}$.

(6.) *Liquor Arsenici et Hydrargyri Iodidi*, U.S. Donovan's solution. (Iodide of arsenic, red iodide of mercury, of each gr. xxxv., distilled water, ℥viij.) *Dose*, ♏ij.—v.

CHAPTER VIII.

ANTISEPTICA (ANTISEPTICS PROPER).

PROCESSES of decomposition in external ulcers and wounds, as well as in the various organs and juices of the body, are produced by certain ferments. These are either yeast-like, that is, possessed of a definite form, like vibriones and bacteria, or else simple liquids, though these soluble ferments are, as far as is at present known, the direct products of cells.

Antiseptic substances arrest the development of yeast in its germinal stage, and prevent the production of liquid ferments by their appropriate cells. In both cases they exert a poisonous action on certain kinds of protoplasm, but, as far as we can at present judge, their influence over the amorphous form is by no means as strong as over the cellular form of protoplasm.

The action of antiseptics mainly depends, either on the direct oxidation of both kinds of ferments by nascent oxygen, or on their indirect oxidation by abstraction of hydrogen, either of which gives rise to a greater or less degree of coagulation of their protoplasm. Their effect is promoted by the circumstance that both kinds of ferments are made up of molecules capable of ready decomposition. This statement, however, does not apply to certain of the most minute organisms which are, at present, regarded as the cause of septic changes within the body. They are very little affected by ordinary chemical reagents (Klebs).

The most important internal antiseptic, inasmuch as it does the least harm to the tissues themselves, is quinia. Owing, however, to the multiplicity of its uses, it will be considered later on under another head. The following drug has a more limited action than quinia:—

Potassæ Chloras ($KClO_3$), B.P., U.S.

Chlorate of Potash. The same salt which is used in chemistry for preparing oxygen. Under certain circumstances it is a powerful oxidising agent, and as such it probably exerts the stimulating and antiseptic property, which it exhibits in ulcerative processes of the buccal and other mucous membranes. It reduces pus while fresh and still warm, and it may possibly act in a similar way, or even more powerfully, on other pathological cells. Such an action would necessarily involve an alteration in the constitution of the latter.

Use.—It is employed with success in stomatitis aphthosa, in diphtheria of the pharynx, in noma, scurvy, and mercurial stomatitis. If given during a mercurial course, it will certainly prevent the outbreak of mercurial inflammation of the mouth, provided the metal itself is administered with proper caution. In the slight affections of the mouth and pharynx, which attack children, its use renders all other treatment unnecessary except the observance of ordinary cleanliness. In the early stage of diphtheria of the pharynx, large internal doses [of a saturated solution (Seeligmüller)] often seem to cut short the disease. In ozœna it surpasses all other topical remedies in efficacy and pleasantness.

It has been recommended as a remedy in toothache, dependent on *caries* (Neumann). Either a moist crystal of the salt should be pressed into the cavity of the offending tooth, or a strong solution (1 : 20) should be used as a mouth wash.

Powdered chlorate of potash sprinkled upon cancerous ulcers, distinctly improves their condition (Burow). Owing to the solubility of the salt it is conceivable that it penetrates undecomposed as far as the lower layers of cancerous cells, and then oxidises and destroys them.

It is best to give chlorate of potash simply dissolved in water, in doses of from gr. iij.—viij., frequently repeated. It has very little taste, and hence does not require any corrective. To a child in the first year gr. j.—ij. may be given as a dose. As a gargle, ʒj. to ℥vj.—viij. water is a useful strength. In ozœna it may be used as a nasal douche, even in the strength of 1 : 17 water, without causing irritation.

Preparation, B.P., U.S.:—

Trochisci Potassæ Chloratis. (Chlorate of potash, sugar, gum acacia, mucilage, water; 5 grs. of chlorate in each lozenge.) *Dose,* 1—6 lozenges.

In ordering this salt in the form of powder, we must remember that it explodes when rubbed up with organic substances, or with sulphur.

The following drug is used almost exclusively as an external application :—

Calx Chlorata, B.P. ($CaCl_2O_2 + CaCl_2$).

Calx Chlorinata, U.S., *Chlorinated Lime.* According to the old view, which has, however, lately been called in question, this is a mixture of hypochloride of lime and chloride of calcium, generally somewhat contaminated with hydrate of lime. Strong acids set free the whole of the chlorine, while weak ones, *e.g.*, the carbonic acid of the air, only liberate the hypochlorous acid. In the solid form it is used to disinfect rooms and chamber utensils. Externally, it may be employed in aqueous solution (1 : 100), to cleanse unhealthy or torpid ulcers; as an injection in gleet, 0·05—0·1 : 150 grammes water; or as an ointment, *e.g.*, in certain parasitic inflammations of the skin, such as scabies; in the latter form the available chlorine is only retained for a short time, and that only if the temperature be low. The British Pharmacopœia contains the following preparations:—

(1.) *Liquor Calcis Chloratæ*, B.P. An aqueous solution of the above (1 : 10), chiefly used as a stimulating and antiseptic lotion.

(2.) *Vapor Chlori*, B.P. Chlorinated lime, ℥ ij., with enough cold water to moisten it. The vapour is to be inhaled from a proper apparatus.

Chlorinated lime can be used in doses of 1—4 grs. in poisoning by sulphides of the alkalies. Its chlorine immediately decomposes the poisonous sulphuretted hydrogen evolved from the latter, with the production of hydrochloric acid and free sulphur.

The next compound closely resembles the above in its properties.

Liquor Sodæ Chloratæ, B.P., *Chlorinatæ*, U.S., *Solution of Chlorinated Soda* ($NaClO$). Made by decomposing a solution of carbonate of soda by chlorine or chlorinated lime. *Dose* internally, ♏ x.—xx. It is sometimes given in septic diseases accompanied with great prostration. It may be applied diluted to unhealthy wounds. As a gargle, ʒ iv.—vj. may be diluted with ℥ xij. of water.

Preparation:—

Cataplasma Sodæ Chloratæ, B.P. (Solution of chlorinated soda, 1 pt., linseed meal, 2 pts., boiling water, 4 pts.) The solution is only to be added after the poultice is mixed.

The German Pharmacopœia contains a *Fumigatio Chlori*, which consists of the ordinary mixture of peroxide of manganese, common salt, and sulphuric acid. It is used when a good deal of chlorine is required for disinfecting rooms, &c.

Bromum, B.P.

Brominium, U.S., *Bromine*. A liquid element soluble in about 33 pts. water, and very closely resembling chlorine in its properties. It has been much recommended in Germany in pharyngeal diphtheria, in the form of an inhalation of 0·2 grammes each of bromine and bromide of potassium in 100·0 water, or as an injection of half that strength in puerperal diphtheria and other similar conditions (Gottwald). As a fact, bromine has a very poisonous effect on the lower forms of life. [It has been used to destroy cancer of the uterus in the following form. Bromine, ♏xij., rectified spirit, ʒj., applied on lint. At the same time, an injection of the following strength is used. Bromine, ♏xij., rectified spirit, ʒij., water, ℥xvi. It has been injected into external cancers as a solution of ♏v. in ʒj. spirit, twenty drops being the dose employed.]

Potassæ Permanganas ($KMnO_4$).

Permanganate of Potash, B.P., U.S. Its old name was *Chameleon mineral*, owing to the rapid play of colours which accompanies its formation in an aqueous solution of green manganate of potash (K_2MnO_4).

It instantly attacks readily oxidisable substances, at the same time being itself reduced to a lower state of oxidation. It also controls the action of ordinary ferments, but owing to its rapid decomposition its action is more transitory than that of other antiseptics. Unhealthy wounds can be deodorised, and disinfected and assisted to heal by frequent washing with the permanganate. The salt can be dissolved in pure spring water (0·5—3·0 : 100·0) and applied as an irrigation.

Preparation :—

Liquor Potassæ Permanganatis, B.P., U.S. (Pot. perm., gr. iv., distilled water, ℥j.)

Dose, if given internally, ʒ ij.—iv.; externally as a lotion, ʒj. : ℥v. water; as a disinfectant of typhoid stools, &c., diluted with 4 pts. water.

It is clear that, in spite of the excessively poisonous action which the salt exerts upon low forms of life, putrid or any other kind of fermentation can still persist in its presence, just as in that of any other antiseptic agent, if the quantity of the drug employed bears too small a proportion to that of the ferment. Hence there is absolutely no safe disinfectant known except actual burning. In dealing with the human *body*, we must be satisfied if we can prevent the *development* of septic degeneration in a wound, or reduce its activity if already developed. In the latter case, any natural tendency to recovery will be materially aided by the disinfectant.

Acidum Boricum (H_3BO_3), Pharm. Germ.

Boracic Acid. A poison to *vibriones* and *bacteria* (Nyström), but not to the mould fungus. It is less irritating than carbolic acid, and is not volatile as the latter is. It is used in a 5 per cent. solution as an irrigating lotion, or else in the form of boracic acid lint. The latter is prepared by soaking lint in a hot saturated solution of boracic acid. On cooling and drying, the acid covers the surface of the lint with fine crystals. It is an almost absolutely unirritating antiseptic dressing, which retains its efficacy for a long time (Lister). [An ointment of boracic acid, 1 pt., white wax, 1 pt., paraffin, 2 pts., almond oil, 2 pts., melted together is also very valuable as an antiseptic dressing.]

The following drug is prepared from wood tar:—

Creasotum.

Creasote, B.P., U.S. A colourless, or yellowish, clear oily liquid, which is heavier than water, in which it is not very soluble, though readily dissolved by alcohol. It is a mixture of several substances, and it contains not only carbolic acid, but also guaiacol and creosol, two ætheriform derivatives of carbolic acid. Since the latter possesses all the principal therapeutic properties of creasote, besides being a well defined and stable compound with a far more agreeable odour, it has to a large extent superseded creasote for medical purposes.

[*Use.*—Creasote is given internally to arrest obstinate vomiting in doses of ♏j.—iij. in a pill with bread, or as the creasote mixture, B.P.

Externally it may be used in a 1 per cent. aqueous solution, as a lotion to ulcers or wounds, or as an ointment in chronic eczema or psoriasis, diluted with white wax in various proportions. An ointment containing gr. v.—x. in ℥j. of simple ointment will often relieve irritation of the skin.

Preparations of Creasote:—

(1.) *Mistura Creasoti*, B.P. (Creasote, glacial acetic acid, spirit of juniper, syrup, distilled water; 1 in 484.) ***Dose***, ℥j.—ij.

(2.) *Vapor Creasoti*, B.P. (Creasote, ♏xij., boiling water, ℥viij.) To be inhaled from a suitable apparatus. Used to arrest purulent secretion from the bronchi.

(3.) *Unguentum Creasoti.* (Creasote, simple ointment; 1 in 9, U.S., 1 in 16.)

(4.) *Aqua Creasoti*, U.S. (Creasote, distilled water; 1 : 128.) *Dose*, ʒj.—℥j. Used also externally as a dressing to wounds, &c.]

Pix Liquida.

Tar. Obtained by the destructive distillation of the wood of various pines and beech trees. It is a very complicated mixture of hydrocarbons, such as naphthalin, paraffin, and creasote, with various acids, such as acetic acid. It is used as an external application in chronic skin eruptions (eczema, psoriasis), in the form of ointment [or it may be used as a paint, dissolved in an equal quantity of rectified spirit]. The German Pharmacopœia prescribes an *Aqua Picis* containing tar 1 pt. in 10 pts. water, which are to be macerated together with frequent shakings for two days and then decanted. It can be used as a lotion or an inhalation. The *Infusum Picis Liquidæ*, U.S. (1 in 5), *dose*, ℥ ss.—j., is a similar preparation.

The external application of tar must be made with caution, since cases of severe poisoning complicated with acute nephritis have occasionally been produced by it. [It is best to use a rather dilute preparation at first, increasing its strength gradually until the proportion of tar which best agrees with the patient's skin has been ascertained. It should always be applied to a small surface of skin at the commencement of the treatment, as in some patients it may cause considerable irritation. The most usual result of tarring large surfaces of skin (in psoriasis) is the production of so-called *tar acne*, due to obstruction and irritation of the hair follicles by the drug. A solution of tar, *e.g.*, the well known *Liquor carbonis detergens* of Wright (1 pt. to 20 pts. water), is an excellent remedy for *pruritus*, in chronic eczema, and other skin diseases attended with itching.

Preparations :—

(1.) *Unguentum Picis* (*Liquidæ*). (Tar, 2 pts., yellow wax, 5 pts., B.P. ; tar, suet, equal pts. of each. U.S.)

(2.) *Glyceritum Picis Liquidæ.* U.S. (Tar, carbonate of magnesium, glycerin, diluted alcohol; 1 in 16.)]

The two following tars which are not officinal are used for the same purpose as Pix liquida, and resemble it in their composition.

(1.) **Oleum Juniperi Empyreumaticum,** *Oil of Cade.* A thick brown liquid distilled from the wood of juniperus oxycedrus. It has a pleasanter smell than ordinary tar.

(2.) **Oleum Rusci,** *Pix Betulina Liquida.* Distilled from the bark of the birch. It is chiefly used in veterinary medicine.

Acidum Carbolicum (C_6H_6O).

Carbolic Acid, Phenylic Acid. When pure it forms beautiful colourless crystals, which turn red under the action of light with the formation of Pheno-Chinon (Wichelhaus), an oxidation product. The commercial acid, which is not quite chemically pure, is hygroscopic and deliquesces in the air. Carbolic acid is formed during the dry distillation of a number of substances, but is generally obtained by the fractional distillation of coal tar. It does not redden litmus paper, and its chemical composition is that of an alcohol.

Action.—Like creasote it is a caustic, especially to the mucous membranes. Owing to its poisonous action on organised ferments it, like the latter, either limits or prevents such processes of decomposition and fermentation as are due to their presence. Its controlling effect is less powerfully exerted on merely chemical ferments. Fresh pus, whatever its characters, when mixed with 5 per cent. of carbolic acid, loses its pyrogenetic power (Rosenbach).

In large doses it acts as a nerve poison on warm-blooded animals, and may cause death after an initial period of increased irritability of the nervous centres. Many such cases of rapidly fatal paralysis of these centres in the human subject have been recorded. Part of the carbolic acid passes unchanged through the system and appears in the urine, to which, owing to conditions which are at present not clearly understood, it occasionally imparts an olive green tint. It can also be absorbed by the intact epidermis, and being carried into the fluids of the body may in this way give rise to poisonous symptoms.

Use.—(1.) Externally, as a disinfectant and antiseptic for a variety of purposes. (2.) As an inhalation in fœtid expectoration from the lungs. (3.) In abnormal decomposition of the contents of the stomach (especially in the more complicated form of creasote). (4.) In infectious diseases. (5.) In certain cases of diabetes (Ebstein and J. Müller), [and in diabetic patients to be submitted to surgical operations]. (6.) As a subcutaneous injection in acute rheumatism (Kunze), 0·01 in 1·0 water being injected into the neighbourhood of the affected joints several times a day. The pain disappears in ½—2 hours. It may be used in the same way in traumatic erysipelas (Hüter). (7.) In chronic skin diseases internally and externally. [Especially in eczema of the hairy scalp, or of the hairy parts in general, 1 pt. to 10 olive oil; as an ointment to relieve itching ʒ ss.—j. : ℥ j. simple ointment.] (8.) As a parenchymatous injection in inflammation of the joints, of the perivascular tissue, and of the lymphatic glands, and as an injection in hydrocele (Hüter). [(9.) In dental *caries*, as a topical application to the nerve, which it rapidly anæsthetises.]

Dose.—*Externally*, dissolved in water, alcohol, olive oil, or glycerin, in from 1—10 per cent. solutions. As an inhalation (Leyden) a 2—4 per cent. solution in peppermint water may be used. As a parenchymatous injection 0·01—0·04 in 1·0—2·0 water.

Internally, from gr. j.—iij. in a pill, or in the following form:—

Glycerinum Acidi Carbolici. (Carbolic acid, glycerin; by measure, 1 in 4¾, B.P.; 1 in 5, U.S.) *Dose*, ♏ v.—x., diluted in water.

If care be taken and the drug be not given on an empty stomach, it is *possible* to administer as much as 30 grains of carbolic acid in pills within 14 hours without any special injury to the stomach or other organs. The following are also officinal :—

(1.) *Aqua Acidi Carbolici*, U.S. (Glycerite of carbolic acid, f ʒ x., distilled water to Oj.) *Dose*, ʒ ss.—℥ ss.

(2.) *Unguentum Acidi Carbolici*, U.S. (Carbolic acid, simple ointment; 1 : 7.)

(3.) *Suppositoria Acidi Carbolici.* (Carbolic acid, curd soap, starch, B.P.; carbolic acid, oil of theobroma, water, U.S.; 1 gr. in each suppository.)

Acidum Carbolicum Impurum, U.S., *Crude Carbolic Acid.* A reddish liquid, which is contaminated with other products of dry distillation, is used for disinfecting closets, utensils, &c. The German Pharmacopœia also contains the following preparation which resembles carbolic acid in its general properties.

Zinci Sulpho-Carbolas, *Sulpho-Carbolate of Zinc.* ($ZnC_6H_4SO_4$). Colourless, almost odourless crystals, which are readily soluble in water. It is chiefly used externally, and its advantages will be evident from the previous sentence. It is said to be less liable than carbolic acid to cause toxic symptoms when used for Lister's dressing. *Dose*, as a dressing, 1—5 per cent. solutions; as an injection, *e.g.* in urethral or vaginal gonorrhœa, 0·1—0·5 in 100·0 water. It is very well adapted for subcutaneous injections of the strength of 1 pt. to 12 pts. water, of which 0·15 or more is to be injected at a dose (Wilde).

Benzinum, *Benzine.* Closely corresponds in its essential action with carbolic acid. It is a mixture of light hydrocarbons, and is like petroleum-æther extracted from American rock oil by fractional distillation. It is heavier than the æther, and has a higher boiling point. It must not be confounded with Benzol (C_6H_6), an accurately defined chemical substance, which also passes under the name of "benzine." It is used in obstinate fermentation of the contents of the stomach, and as an anthelmintic, especially in recent trichinosis. *Dose* ♏x.—xx., and still more if given as an enema. It is very inflammable.

The next two drugs are disinfectants of a peculiar kind.

Carbo Ligni, *Wood Charcoal.* Finely pulverised and freed from salts by washing. When freshly burnt it absorbs and partially oxidises the gases produced by organic decomposition, absorbing, for example, fifty-five times its volume of sulphuretted hydrogen. It has been chiefly used in the form of powder, though formerly more than at present, to sprinkle the surface of unhealthy ulcers and wounds. *Internally* it has been given in pyrosis, and in cases of abnormal development of gases in the stomach, generally in association with bitter medicines. *Dose*, gr. xx.—lx.

The *Cataplasma Carbonis*, B.P., consists of wood charcoal, bread, linseed meal, and boiling water.

Carbo Animalis Purificatus, B.P., U.S., *Animal Charcoal.* Obtained by digesting bone black with dilute hydrochloric acid. In Germany, it is made by heating to redness a mixture of two-thirds finely chopped veal and one-third bones. It contains a trace of empyreumatic oil in addition to the bone earth. Its absorbent power is greater than that of wood charcoal. If phosphorised oil be filtered through it *in vacuo*, the filtrate contains no phosphorus (Eulenburg and Vohl), hence animal charcoal, preceded by an emetic of sulphate of copper, has been recommended, *inter alia*, in poisoning by phosphorus. It has also been proposed as a remedy in poisoning by strychnia, morphia, aconitia, and other alkaloids. As long as the latter remain in the stomach the charcoal may absorb them and prevent their entering the circulation. *Dose*, gr. xx.—lx.

[**Cerevisiæ Fermentum,** B.P., U.S., *Beer Yeast.* Chiefly consisting of the cells of Torula Cerevisiæ, confervoid growth, propagated during the fermentation of malt liquors. It is almost obsolete, but was formerly used internally in the treatment of boils, typhoid fever, &c., and externally in the form of poultice to stimulate and cleanse unhealthy wounds. In the latter capacity it may be satisfactorily replaced by carbolic acid, boracic acid, and other modern antiseptics.

Dose, of fresh yeast, ℥ ss.—j., *secundis horis.*

Preparation :—

Cataplasma Fermenti, B.P. (Yeast, 6 pts., flour, 14 pts., water at 100° Fahr., 6 pts.) To be placed near the fire till it rises.]

CHAPTER IX.

ANTIPYRETICA.

REMEDIES WHICH REDUCE FEVER.

THE group of symptoms known as "fever" is especially distinguished by excessive combustion of albumen and of the tissues generally, and by a corresponding elevation of the temperature of the body. Both these phenomena cause degeneration of the organs and exhaustion of the nervous system. There are two chief methods of reducing fever open to us, either (1) to increase the escape of heat from the body, or (2) to check the production of heat within it. As far as our present knowledge extends, the drugs which belong to the present group chiefly perform the latter function.

Cinchonæ Cortex.

Cinchona bark. The bark of the trunk and twigs of several species of the genus Cinchona (Rubiaceæ), natives of Bolivia and Peru.

Linnæus gave the name of Cinchona to these trees in honour of the Countess of Cinchon, who was cured of fever by the bark in 1639, and who first sent specimens of it to

Europe. Quinia is derived from the Peruvian word *Quina*, which means bark.

Cinchona bark *contains* several bases and acids which vary in kind and quantity with the species of tree. Those which are important for medical purposes are (1) Quinia, (2) Cinchonia, (3) Tannic acid, (4) the bitter Quinovine, which is a glucoside. The most important of these constituents is the alkaloid quinia (quinine), ($C_{20}H_{24}N_2O_2$).

The action of cinchona bark mainly depends on this alkaloid. When given in large doses, and in a form which is not readily soluble, it excites dyspepsia in the stomach. Readily soluble preparations administered in moderate doses promote digestion, are quickly absorbed, and under ordinary circumstances soon appear in the urine. Quinia, when given in a somewhat insoluble form, can be detected in the urine, partly in an amorphous condition, as late as seventy-two hours after its administration. About 70 per cent. of its ordinary salts are excreted in the urine within a period of from 3—24 hours (Kerner). In healthy persons, and in most febrile patients, it is not decomposed in passing through the blood, but is entirely excreted by the kidneys and bowels. It is only in typhoid fever that a deficit of about 24 per cent. has as yet been observed (Welitschkowski). Smaller doses frequently repeated, or large single doses, sometimes irritate the kidneys and bladder, especially in elderly people. Similar doses (about 1·0—1·5 may be regarded as an average dose for adults), are very generally followed by giddiness, ringing in the ears, vomiting (which also occurs if the drug be subcutaneously injected), sleeplessness, and general prostration. Sometimes there are disturbances of hearing or vision, which may last for several days. Part of these toxic effects depend on impairment of the heart's function; thus the frequency of the pulse, and probably also the pressure in the arteries, increases after small doses, while the contrary effect is produced by large ones. In the latter case, the lowering of pressure has been experimentally proved; it is accompanied by a small and infrequent pulse. Still larger quantities, *e.g.*, about 12—15 grammes administered in one dose to the human subject, may cause death with all the symptoms of general paralysis. Experiments on warm-blooded animals have proved that the injury to the heart, and still more the paralysis of the respiratory centre, are the cause of death. The latter event can be postponed by artificial respiration, and in that case is due to paralysis of the heart, this organ being found immediately before death to have lost all its irritability. Quinia has no appreciable effect on the cardiac branches of the vagus nerve, and the section of the latter, either before or after the introduction of the alkaloid, does not materially alter the symptoms of poisoning. The respiration is not affected by doses which in other respects exhibit a powerful action. [*Vide* note on Quinia Rash in Appendix A.]

The spleen of warm-blooded animals contracts under the influence of quinia within a few hours. It becomes tougher and its surface is thrown into folds. These phenomena are not prevented by the previous section of the afferent nerves (Mosler).

The depression of reflex irritability, which quinia produces (in frogs), and which has been much discussed, is due to an interruption of the circulation owing to paralysis of the heart. Such a depression has not as yet been observed in warm-blooded animals even after powerfully antipyretic doses.

Quinia (in the following remarks allusion has always been made to one of the ordinary weakly basic, or at the most neutral, salts) even in moderate doses, temporarily lowers the temperature in healthy warm-blooded animals, but in most febrile conditions it lowers it still more readily. In healthy adult men, a single dose of a little more than 1·5 grammes reduced the total amount of urea excreted by 24 per cent., and the sulphuric acid by nearly 40 per cent., whereas it raised the quantity of water excreted to a small extent (Kerner). Similar results were obtained in dogs (v. Boeck). The excretion of carbonic acid by the lungs was not diminished, either in healthy or febrile rabbits, although at each dose the temperature was most distinctly lowered. Solutions of albumen are converted into peptones if shaken up in an atmosphere of nascent oxygen, but this change is prevented if quinia is present (Rossbach). Even in relatively small quantities it prevents the putrefaction of nitrogenous substances, as well as several simpler fermentative processes which have been specially examined. In both cases it acts directly on the protoplasm, of which the substances which excite such processes, or their germs, are composed. Other *amorphous* ferments such as ptyalin and pepsin have their properties very slightly, or not at all, arrested by quinia, and there are several protoplasmatic organisms on which it has no poisonous effect whatever, whereas it reacts on others with unexpected vigour. The poisonous action of many putrid fluids upon warm-blooded animals may be neutralised either completely, or as far as certain symptoms are concerned, by the simultaneous administration of quinia.

Owing to the energy with which it paralyses certain kinds of protaplasm, quinia diminishes the absolute number of white blood corpuscles in the body. The lymphatic glands become small and are found on section to be abnormally dry, while splenic enlargements, due to hyperplasia of the lymphatic follicles, and to the increased tissue change within the organ by which it is accompanied, are reduced or prevented.

The escape of white blood corpuscles from the vessels, and the suppuration which ensues, can be distinctly limited in animals by quinia. Its effect in this instance is, at any rate in the main, independent of the condition of arterial pressure. It is due to a lowering of the affinity of the corpuscles for the oxygen of the hæmoglobin, this oxygen being the stimulus which excites the independent movements by which emigration from the veins and capillaries is partly effected.

Fresh vegetable juices containing protoplasm, and also healthy pus, both of which ordinarily give the reaction of nascent oxygen with tincture of guaiacum or indigo, lose this property when mixed with relatively weak solutions of quinia. The reason of this is that the quinia prevents the protoplasm from absorbing oxygen from the atmosphere, and so from undergoing the special alteration to which the above reaction is due. Phosphorescent infusoria, *i.e.*, those which are continually undergoing powerful oxidation, completely lose their phosphorescence on the addition of minute quantities of quinia.

The addition of quinia to blood which has been recently drawn, not only diminishes the physiological production of acid which occurs immediately after its removal from the body, but also its power of transferring active oxygen to oxidisable bodies. The latter effect also takes place with pure hæmoglobin, without its being possible to detect any decomposition of the latter spectroscopically during the presence of the quinia. On the contrary, when blood which contains quinia is heated, the lines which indicate oxygen disappear at a higher temperature than the same lines in pure blood used for comparison (Rossbach).

The *penicillium* fungus, when mixed with hæmoglobin outside the body, withdraws oxygen from it, and this process is arrested by quinia (Preyer). All things considered, and taking into consideration the alterations in size which the red blood corpuscles undergo under its influence, it seems probable that while the quinia renders certain cells within the human organism still less fitted than before for the absorption of oxygen, it binds that element more firmly to the hæmoglobin.

The fall of temperature which quinia so frequently produces in fever (0·5°—4·0° and more, Cent.) is independent of the heart, and also of those portions of the nervous system which take origin in the brain, and pass downwards through the spinal cord, for it still takes place after the cervical portion of the latter has been completely divided. Nor does it appear to depend on an increased emission of heat from the skin (Jürgensen, Lewizky). Among other causes we should first think of some inhibitory effect exerted by quinia over the functional activity of the protoplasmatic cells of the heat-producing organs. Even the normal cells become slightly depressed by its action, especially when they are producing an unusual amount of heat under the stimulus of pyretic substances; and those infective poisons (whether they be organised, or merely in solution), which are capable of self-multiplication in the body after a more or less regular period of incubation, and of acting as irritants to these cells, are either rendered by quinia incapable of further development, as in malaria, or have their energy paralysed, as happens to some extent in typhoid fever.

We are ignorant of any direct relations between quinia and the nervous system, which might be utilised for therapeutic purposes, although we cannot deny that such may exist. Any direct "tonic" influence exerted by quinia upon the nervous system is at present purely hypothetical, and unsupported by a single experiment. As far as observed and experimental facts enable us to form a general conclusion, the action of quinia is not a "specific" one in the ordinary sense, for other bodies, like alcohol, the acids, the æthereal oils, and most of the officinal vegetable bases, agree with it in their essential properties, though these properties are better characterised in the case of quinia, owing to the fact that the latter, if introduced into the human organism, neither undergoes rapid decomposition nor produces especially poisonous symptoms as the other bodies do.

Its essential difference from chemically allied molecules, such as morphia, strychnia, veratria, &c., consists in the fact that it does not meet with any albuminous body in the nervous system, for which it has a marked affinity.

What is meant by specific properties is simply, that quinia has a stronger chemical affinity for one or more pyretic poisons, and especially for that from which malaria originates.

The *uses* of cinchona bark are, as will be understood from the foregoing remarks, and as the practical medicine of the last 200 years proves, extremely various. At present, either the bark, or its most important alkaloid, is used,

(1.) As an antidote in many forms of purulent infection.

(2.) To check suppuration in its early stages.

Of course, quinia is only effectual here, if the pus can be evacuated externally, or if the intensity of the inflammation bears an adequate relation to the amount of quinia which it is possible to administer. In acute pneumonia, 50 cubic centimetres of a half per cent. solution may be given as an inhalation twice a day, late in the evening (Gerhardt).

(3.) For the removal of certain splenic tumours.

Especially in hyperplasia of the Malpighian corpuscles, [*e.g.* leucocythæmia (Mosler).] Amyloid degeneration and enlargements are not curable by quinia.

(4.) To reduce high and exhausting temperatures.

Neither the fever of relapsing fever nor that of certain forms of erysipelas is much affected by quinia. Probably, this arises, not from the extraordinary severity of the fever, but from the nature of the pyretic agent. Even in those cases of fever which are amenable to it, its effect is only appreciable when it is given in large doses, at that time of the day when the temperature is lowest, and in an easily digestible form.

(5.) As a lotion in specific catarrhs, such as hay fever (Helmholtz and others), and whooping-cough, as well as in certain infectious inflammations of the exterior of the eye.

(6.) As a dressing to unhealthy wounds and ulcers.

In ulcerating cancer it may remain for several days on the wound without renewal, and it prevents decomposition without causing irritation (Struck).

(7.) In dyspepsia and chlorosis; in the latter combined with iron.

Quinia is also used with success in neuralgia, especially of the fifth nerve. Such neuralgias are generally the residue of malarial infection, and they are probably to be regarded as the expression of a local irritation, excited by the malarious poison, or by some similar agency. Quinia is superior to morphia and the two hydrates of chloral, because by its means it may be possible to effect a permanent cure, whereas the action of the narcotics is only temporary. It is true that large doses of quinia are often required for this purpose, *e.g.*, in one case (Naunyn), eight grammes were given in the course of twenty-four hours.

The *Preparations* of cinchona bark are very numerous, but several of them at present have only a chemical interest.

The following are officinal:—

(1.) **Cinchonæ Flavæ Cortex.** The bark of *Cinchona Calisaya.* It must contain at least 2 per cent. of bases, amongst which the proportion of the active principle quinia is much larger than that in

(2.) **Cinchonæ Pallidæ Cortex.** The bark of *Cinchona Condaminea*, Peruvian bark, which is richer in Cinchonia.

(3.) **Cinchonæ Rubræ Cortex.** The bark of *Cinchona Succi Rubra*, which resembles Cinchona flava in the alkaloids it contains. The *dose* of these three barks is from gr. x.—xv. several times a day, but in ague from gr. xx.—lx., or more, must be given at each dose in the intervals between the fits. A good way to administer them is as a decoction in distilled water with a few drops of hydrochloric acid.

Preparations of Cinchona Flava:—

(1.) *Decoctum Cinchonæ*, B.P. U.S. (1 in 16.) *Dose*, ℥ j.—ij.

(2.) *Extractum Cinchonæ Liquidum*, B.P. (Yellow bark, distilled water, rectified spirit; 1 pt. is equal to 4 pts. of bark.) *Dose*, ♏x.—xxx. The U.S. *Extractum Cinch. Fluidum* also contains glycerin, and one fluid ounce represents one ounce of bark. *Dose*, ♏x.—lx. U.S. has also *Extractum Cinchonæ*. *Dose*, gr. j.—x.

(3.) *Infusum Cinchonæ*, B.P. (Bark, water; 1 in 20.) *Dose*, ℥j.—ij. U.S. contains aromatic sulphuric acid. (Strength, 1 in 16.) *Dose*, ℥ss.—ij.

(4.) *Tinctura Cinchonæ* (Bark, proof spirit; 1 in 5.) *Dose*, ʒj.—ij., B.P.; ʒj.—iv., U.S.

(5.) *Quiniæ Sulphas*. (*Vide infra.*)

Preparation of Cinchona Pallida:—

Tinctura Cinchonæ Composita, B.P. (Pale bark, bitter orange peel, serpentary, saffron, cochineal, proof spirit; 1 in 10.) *Dose*, ʒss.—ij.

Preparations of Cinchona Rubra:—

(1.) *Decoctum Cinchonæ Rubræ*, U.S. (1 in 16.) *Dose*, ℥ss.—j., or more.

(2.) *Tinctura Cinchonæ Composita*, U.S. (Red bark, bitter orange peel, serpentary, diluted alcohol; 1 in 10.) *Dose*, ʒj.—℥ss.

(3.) *Infusum Cinchonæ Rubræ*, U.S. (1 in 16.) *Dose*, ℥ss.—ij.

Quiniæ Sulphas.

Sulphate of Quinia, Quinine. The neutral, or, according to some views, *basic* sulphate. It has an intensely bitter taste. One part is soluble in 1,000 pts. water, or in 200 alcohol. In intermittent fever and similar conditions it is given in doses of gr. viij.—xv., in the interval between the fits, and not too long before the reaccession of fever. In other diseases it is given in very variable doses, ranging from gr. iss.—viiss. every two hours, or a gramme and upwards twice a day.

Sulphate of quinia has the disadvantage of being very insoluble, hence it is liable to upset the stomach when given in the form of powders or in pills, and may thus possibly escape absorption altogether. If given in water, a little hydrochloric acid should be added to it, since this acid suits the stomach best, and the solution containing it does not so readily become mouldy as when sulphuric acid is used instead.

The complaint has been often made that quinia is apt to cause sickness, and it is generally supposed that it does so by direct irritation of the stomach. This is not proved to be the case. On the contrary, if the quinia be continued in similar doses to the first, at the most only a small part of the second or third dose will be rejected, and all later ones will be tolerated. It is very important not to use impure quinia, especially such as contains the less active Cinchonia. The latter may be detected by adding a little ammonia to a solution of the pure sulphate of quinia. The alkali throws down a dense precipitate of hydrate of quinia, and by redissolving the latter in æther any hydrate of cinchonia present remains behind.

The following test is applicable to all the secondary alkaloids of Peruvian bark. Put 1·0 gramme of the quinia salt into a test tube with 10·0 water at a temperature of about 15° Cent., shake the mixture vigorously, and let it stand for half an hour. Mix 5 cubic centimetres of the filtrate gently with 7 cubic centimetres of ammonia of about 0·96 specific gravity, so that they shall not mix at first, and then gently mix the two liquids. If the quinia salt be pure, no precipitate whatever will appear, either at once, or on standing (Kerner).

The sulphate of quinia must not change colour in the least on the addition of concentrated sulphuric acid, even if heated. A red tinge indicates salicin, a black one sugar, &c. The sulphate must, of course, be thoroughly soluble in dilute sulphuric acid (absence of starch, resins, &c.), as well as in spirit of wine (absence of gum, plaster of Paris, &c.). On a platinum spatula it must burn away without leaving any residue.

Preparations of Sulphate of Quinia :—

(1.) *Pilulæ Quiniæ* (*Sulphatis*). (Gr. j. in 1⅓, B.P. ; gr. j. in each pill, U.S.) *Dose*, gr. ij.—x., B.P. ; 1—3 pills, or more, U.S.

(2.) *Tinctura Quiniæ*, B.P. (Sulphate of quinia, tincture of orange peel ; 1 in 60.) *Dose*, ʒ j.—jss.

(3.) *Tinctura Quiniæ Ammoniata*, B.P. (Sulphate of quinia, solution of ammonia, proof spirit ; 1 in 60.) *Dose*, ʒ j.—ij.

(4.) *Vinum Quiniæ*, B.P. (Sulphate of quinia, gr. xx., citric acid, gr. xxx., orange wine, ℥ xx.) *Dose*, ℥ ss.—j.

The following preparations of cinchona are contained either in the German or U.S. Pharmacopœia :—

(1.) **Cinchonia** ($C_{20}H_{24}N_2O$). An alkaloid differing very little from quinia in its empirical constitution, but weaker in its action.

Preparation :—

Cinchoniæ Sulphas, U.S., *Sulphate of Cinchonia.* Made by precipitating the mother water which remains after the crystallisation of sulphate of quinia by a solution of soda, washing, drying, purifying from other alkaloids by alcohol, and finally treating with dilute sulphuric acid. The salt forms white shining crystals, and is soluble in 54 pts. of cold water, or in 7 pts. of alcohol. *Dose*, gr. j.—xv.

(2.) **Quiniæ Valerianas,** U.S., *Valerianate of Quinia.* A colourless salt, crystallising in rhomboidal tables, with a repulsive odour and bitter taste. *Dose*, gr. j.—xx.

(3.) **Quiniæ Hydrochloras**, *Hydrochlorate of Quinia*, Pharm. Germ. A salt soluble in 25 pts. water. It contains rather more of the active base than the sulphate (83 per cent. instead of 74). *Dose*, gr. ss.—xv.

The pure *Amorphous Hydrochlorate of Quinia* which has lately been introduced into commerce is especially adapted for subcutaneous injection. It dissolves in an equal weight of water, is very cheap, and, as a rule, does not give rise to abscesses. The skin at the seat of injection should be gently rubbed to promote absorption.

(4.) **Quinoidin.** An amorphous, resinous, brown modification of crystalline quinia, from which it is formed under the action of light. It is often contaminated with the other alkaloids, and with various impurities. When pure, its action is very nearly that of quinia, but begins much earlier; and owing to the rapidity with which it is excreted, is sooner exhausted.

Preparation:—

Tinctura Chinoidini, Pharm. Germ. (Quinoidin, 2 pts., alcohol, 17 pts., hydrochloric acid, 1 pt.) *Dose*, ʒ ss.—j., diluted.

Beberiæ Sulphas, B.P. ($C_{35}H_{40}N_2O_6H_2SO_4$).

Sulphate of Beberia. Prepared from the bark of Nectandra Rodiæi, the Greenheart tree from British Guiana (Lauraceæ). The sulphate forms dark brown translucent scales with a very bitter taste. It is soluble in water (1 in 80).

The physiological *action* of Beberia resembles that of quinia. Like the latter, it destroys the microscopic organisms of decaying and putrid matter, but, except in the case of certain salt water *infusoria*, less energetically. A 1 per cent. solution of the sulphate at once destroyed the hyaline processes of *Euglena viridis* and checked their movements, while it took a solution of hydrochlorate of quinia of equal strength thirty minutes to effect the same result. Beberia also temporarily reduces the number of white blood corpuscles, and the action of solutions of sulphate of beberia and of hydrochlorate of quinia (1 : 1,000) in arresting the amœboid movements of the white blood corpuscles, is almost identical. On the other hand, sulphate of beberia retards the fermentation of sugar by yeast, as measured by the volume of CO_2 evolved, more powerfully than hydrochlorate of quinia. Like the latter, beberia is excreted by the kidneys (Binz).

Use.—Beberia has been given in the same conditions as quinia, but its use does not seem to have been attended with much success. In typical cases of ague it completely failed, where quinia was immediately successful (Garrod). *Dose*, gr. j.—v. or x.]

Acidum Salicylicum ($C_7H_6O_3$), not officinal.

Salicylic Acid.—This was formerly prepared from Salicin, the bitter principle of the willow and poplar barks, and it occurs in the form of salicylate of methyl as one of the component parts of the essential oil of the American *Gaultheria procumbens* (Winter Green*), and of the European *Spiræa ulmaria* and *Monotropa hypopitys*. It is now prepared on a large scale by Kolbe's process, by heating carbolic acid with hydrate of sodium in a suitable vessel, and passing a stream of carbonic acid through it. Salicylate of soda is formed, from which the salicylic acid can be set free by any stronger mineral acid. When pure, it appears in the form of beautiful white acicular crystals which have no smell, and which are readily soluble in alcohol, æther, and alkalies, but only dissolve in water in the proportion of 1 : 300. If heated with care it sublimes; too much heat decomposes it into carbolic acid and carbonic acid:—$C_7H_6O_3 = C_6H_6O$ (Carbolic acid) $+ Co_2$.

Action.—Internally, its effects closely resemble those of quinia, even to the production of ringing in the ears and transient deafness. Large doses alone act as a direct poison on the heart and respiration. It is only partly destroyed in its passage through the organism, and reappears in the urine as late as fifty hours after it has been taken, partly as such and partly as Salicyluric acid ($C_9H_9NO_4$). Its curative properties are hence due (1) to this resistance to decomposition; (2) to its harmlessness even in gramme doses; and probably (3) to the direct arrest of certain fermentative processes, which we must regard as the exciting cause of various diseases.

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* Oil of Winter Green is officinal, U.S. Pharm., and is contained in *Trochisci Morphiæ et Ipecacuanhæ* and *Syrupus Sarsaparillæ Compositus.*

Salicylic acid acts as a poison on many forms of protoplasm, by considerably reducing their power to absorb oxygen. Even in small doses it checks a variety of processes which depend on decomposition. Like quinia, it does not interfere with the normal ferments of the organism itself. A dose of 4—5 grammes only very slightly reduces the temperature of healthy adults, whereas it causes a marked reduction in many febrile diseases. It has been found to check septic and pyæmic, but not inflammatory, fever in animals (Fürbringer). Its antipyretic action in the human subject is often preceded, or accompanied by copious perspiration, though the latter may be completely absent. The fall of temperature is independent of any alteration in the pulse or respirations, and may occur without any perceptible deviation of either from its previous state.

The depression of temperature is as decided in the interior of the body as in the axillæ (Ewald).

It is still a matter of dispute in what form the acid circulates in the blood. The view that it *must necessarily* be present as the neutral soda salt is purely hypothetical. If any substance is present which readily combines with salicylic acid, the carbonic acid of the blood replaces it in its former combination. Hence the carbonic acid, of which 700 grammes are excreted daily by an adult, and which is sometimes increased as much as three-fold in inflamed tissues (Ewald), may equally well prevent the formation of the neutral salt in the circulation, and still more in the tissues.

Use.—(1.) In the most various febrile conditions. In some forms, *e.g.*, phthisis and erysipelas, and especially acute rheumatism, it has a better effect than quinia, while in malarial poisoning it is inferior to it.

Cases of unpleasant collapse have been recorded, where the action of a large antipyretic dose coincided with the period when the disease itself tended to a natural and rapid defervescence, for example, in acute pneumonia.

(2.) In internal conditions, accompanied by decomposition, *e.g.*, in gangrene of the lungs, stomatitis, gastric fermentation, dysentery, and cystitis with ammoniacal urine.

(3.) Externally, in the form of Lister's dressing, and for a number of similar uses.

Salicylic acid has here the advantage over carbolic acid, that it has no smell, and causes less local irritation.

Preparations:—The principal is the neutral *Salicylate of Soda*, an odourless, whitish powder, soluble in water in all proportions, and possessing an unpleasant, sweetish taste. Therapeutically, it resembles the free acid, but is more pleasant to take, and more rapidly absorbed. It has a stronger action on certain forms of bacteria than carbolic acid, quinia, boracic acid, and alcohol, and one which is scarcely a third less powerful than that of free salicylic acid (Dragendorff and Bucholtz).

Another preparation of salicylic acid is **Salicin** ($C_{13}H_{18}O_7$). It is decomposed by certain ferments, *e.g.*, saliva, with the absorption of water, into Saligenin ($C_7H_8O_2$) and sugar. The saligenin is afterwards readily oxidised into salicylic acid. The conditions necessary for both these processes exist within the body. Salicin is a moderately bitter, crystalline body, readily soluble in water. It was formerly used as a substitute for quinia, though it did not render much more service then than its derivative does now, in the limited range of febrile affections to which quinia was therapeutically applied.

The new data which we possess with regard to the value of quinia in forms of fever other than malaria, as well as the discovery of the antipyretic property of salicylic acid, have recalled public attention to the value of salicin. In doses of from 8 to 10 grammes it depresses the temperature in many diseases as certainly as salicylic acid [though to a less degree]

(Maclagan, Senator), under which form part of it reappears in the urine. It is not adapted for use as an external antiseptic.

Dose.—Of salicylic acid from 1·0—6·0 grammes dissolved in a solution of bicarbonate of soda [or in liquor ammoniæ acetatis (gr. xv. in ʒ ij.)]. Its soda salt may be prescribed in pills, or, best of all, in solution in water to which a little extract of liquorice has been added as a corrective. Salicin may be given in powder (best in wafers containing 1—1·5 grammes each) or in solution. Salicylate of soda may be used as a subcutaneous injection of the strength of 1 pt. to 1—2 pts. water.

Creasotic Acid ($C_8H_8O_3$). Is derived from coal-tar Creasol (C_7H_8O) by the addition of a molecule of carbonic acid. It forms colourless, odourless needles, and possesses antipyretic and antiseptic properties. It is given in the same doses as salicylic acid. The fall of temperature which it produces is in this case also independent of the pulse and of increased escape of heat by the skin (Buss).

Amygdalæ Amaræ.

Bitter Almonds. The fruit of *Amygdalus Communis* (Amygdalaceæ). A variety of the cultivated almond tree which produces sweet almonds, bears bitter almonds.

Their *constituents* are (1.) *Amygdalin*, a crystalline, bitter substance, readily soluble in water. From 100 grammes of bitter almonds Liebig extracted about 1·5 grammes. (2.) *Emulsin* (Synaptase), an albuminoid which is also present in sweet almonds. (3.) Fatty oil, sugar, &c. By the action of emulsin upon amygdalin at a gentle heat, the latter absorbs water, and is converted into sugar, æthereal oil of bitter almonds, and *Hydrocyanic acid* (HCN). This process is still used in Germany for the preparation of the officinal *Aqua Amygdalarum Amararum* by distillation with water. The product is said to contain $\frac{1}{10}$ per cent. of pure hydrocyanic acid.

Preparation :—

Aqua Amygdalæ Amaræ, U.S. (Oil of bitter almonds, ♏xvj., distilled water Oij.) *Dose*, ℥ ss.—j.

The British and American Pharmacopœias prepare this acid by distilling ferrocyanide of potassium with dilute sulphuric acid, the product

Acidum Hydrocyanicum Dilutum

Containing 2 per cent. of anhydrous hydrocyanic (Prussic) acid.

Action.—Hydrocyanic acid when externally applied causes slight irritation, and afterwards anæsthesia, of the affected part. [It probably thus allays the pruritus of eczema and other diseases accompanied by itching.] Internally, if given in sufficiently large doses, it very quickly stimulates the terminal fibres of the vagus nerve in the lungs and heart, and then paralyses these organs, causing death by asphyxia. This effect occurs with extraordinary rapidity if the gas is inspired. If the dose be carefully adjusted, hydrocyanic acid diminishes the number of cardiac pulsations and increases their force.

The temperature in the living animal falls even after doses which are not poisonous (Manasseïn). Even very small quantities of the acid interfere with the exchange of gases in the blood. The venous blood has an arterial tint, since the arterial blood less readily parts with its oxygen to those tissues which ordinarily attract it. Oxyhæmoglobin forms a combination with it which no longer possesses the well-known "ozonising" properties of the former body.

Even very minute quantities of hydrocyanic acid impair the contractility of the white blood cells, as well as their power (in the form of pus) of setting up oxidation by the development of nascent oxygen. In the same way vegetable protoplasm, when liberated from its cells and suspended in water, loses its great affinity for oxygen under the action of hydrocyanic acid, but recovers it after the latter has evaporated.

In warm-blooded animals less oxygen is absorbed, and carbonic acid excreted, after the administration of hydrocyanic acid (Gaethgeus). This accords with Hiller's recent observation that the spectrum of the blood-vessels indicates a diminution in the amount of oxygen in combination with hæmoglobin.

Hydrocyanic acid has strong antiseptic properties, and also energetically checks other forms of fermentation.

To sum up its therapeutic effects on the animal body (its poisonous irritative action on the vagus nerve (Preyer) can scarcely be utilised for treatment), we may say that it probably is able to limit the *internal* respiration, *i.e.*, the absorption of oxygen in the functionally active tissues, when given in such moderate doses as do not interfere with the functions of the pneumogastric nerve.

Hydrocyanic acid, like quinia, alcohol, and cold, exerts a definite influence on the red blood corpuscles. In animals suffering from fever the latter are invariably reduced in size, probably because they give off more oxygen, owing to increased systemic tissue change. Now hydrocyanic acid and the three other agents above mentioned, produce an opposite effect when given in less than fatal doses, that is to say they cause the red blood cells to reassume larger dimensions. This effect can be referred both to a limitation of the consumption of oxygen in the tissues, and of the evolution of oxygen from the corpuscles; for experiment proves that the action of this gas on blood, both within and without the body, is in either case to increase the size of the red corpuscles (Manasseïn).

Use.—To diminish general or local symptoms of irritation, especially when accompanied with fever, but in which other narcotics are for any reason contraindicated. It is, however, often combined with morphia. [It is often prescribed in doses of ♏j.—v. to allay gastrodynia and nausea accompanying dyspepsia, also in actual vomiting, frequently combined with an alkali or with bismuth.

Externally, as a lotion, it checks the itching of eczema and urticaria (♏ v.—xx., ad ℥ j. aq.), or as an ointment of ʒ ss.—j. in ℥ j. *ung. simplicis.* It should be used with great care.]

The following preparation is officinal:—

Vapor Acidi Hydrocyanici, B.P. (Hydrocyanic acid, ♏ x.—xv., cold water, ♏ lx.; for one inhalation.) Sedative in laryngeal irritation.

The next preparation resembles the acid in its properties, but is less definite in its composition.

Aqua Laurocerasi, B.P. (Made by distilling fresh cherry laurel leaves with water; 1 in 1¼.) *Dose*, ♏ v.—xxx.

ACIDA (ACIDS).

The mineral acids when applied locally in a very diluted form to the tissues exert an astringent action, as is very distinctly proved by their effect on the tongue. In the stomach, if given in at all large doses, they seriously impair digestion, partly by limiting its secretion, and partly by altering the chemical conditions on which digestion depends; but if carefully administered, they arrest abnormal processes of fermentation and decomposition.

In the animal juices, they are present in combination with bases and albuminates. They are often excreted in the urine as acid salts. In various species of animals, the introduction of a diluted mineral acid into the stomach slightly diminishes the alkalinity of the blood, and the same must be true of all the plasmatic liquids of the organism (Lassar). According to the present state of our knowledge this must result in diminished internal combustion, and in lessened physical tissue change; the former, because many substances only combine with oxygen when in an alkaline solution, and the latter, because the diffusion of albumen is promoted by alkalies, and impeded by acids (Heynsius). It is also conceivable that the general antagonism of acids to hæmoglobin is due to the same reasons. At present, at any rate, the fact is certain that large but not poisonous doses of acids, when taken by men and other warm-blooded animals, slightly lower the temperature and also the frequency of the pulse. The above considerations probably partly explain the empirical reputation which ordinary acids have long enjoyed as antipyretics and antiphlogistics. The physiological examination of this question has not, however, as yet advanced beyond its earliest stages.

To this subdivision of antipyretics belongs

Acidum Sulphuricum (H_2So_4).

Sulphuric acid, Oil of vitriol.

Preparations :—

(1.) *Acidum Sulphuricum Aromaticum.* (Sulphuric acid, rectified spirit, powdered cinnamon, powdered ginger; B.P. contains 10·9 per cent. anhydrous acid; U.S., 10·5 per cent.) *Dose,* ♏ v.—xxx.

(2.) *Acidum Sulphuricum Dilutum.* (The pure acid diluted with water. It contains 11·14 per cent. anhydrous acid, B.P., and has a specific gravity of 1·094. U.S. specific gravity, 1·082.) *Dose,* ♏ v.—xx. largely diluted.

(3.) *Infusum Rosæ Acidum,* B.P., *Compositum,* U.S. (Red rose petals, diluted sulphuric acid, boiling distilled water; U.S. contains sugar also; 1 in 40.) *Dose,* ℥ j.—ij.

Use.—Dilute sulphuric acid is given in diseases in which there is a continuous elevation of temperature, and in chronic digestive disturbances which are not accompanied with lesion of the gastric mucous membrane. [The aromatic acid is also used as an astringent in diarrhœa, and is sometimes prescribed in hæmoptysis, and other internal hæmorrhages, though its efficacy in such cases is extremely doubtful. The acid infusion of roses is given as a so-called "refrigerant," as a mild astringent, and is used externally as a gargle. Dilute sulphuric acid is largely used in England to dissolve sulphate of quinia.]

Much use has been recently made of sulphurous acid, *Acid Sulphurosum*, especially in England. It is a solution of sulphurous acid gas (SO_2) in about one-thirtieth of its volume of water. Owing to the powerfully deoxidising and ozonising properties of this gas it serves, as is well known, to arrest or prevent putrid decomposition, and its use in the gaseous form as a disinfectant of rooms and other enclosed spaces depends on these properties (Hoppe-Seyler). It is believed and asserted that its aqueous solution has a similar action on septic processes within the body.

For the same reason the *alkaline sulphites* and *hyposulphites* have been credited with great curative powers in all kinds of infectious conditions, such as intermittent fever, typhus, pyæmia, small-pox, &c.; and they have also been recommended for external use in the treatment of unhealthy wounds. According to Polli they agree with pure sulphurous acid in checking putrefaction and fermentation, as well as artificial septicæmia,* and they can also be administered in doses of several grammes without causing any bad effects, except, perhaps, occasional diarrhœa. The following preparation is officinal in Germany and America:—

Sodii Hyposulphis, U.S., *Hyposulphite of Soda* ($Na_2S_2O_3$). In the presence of a free mineral acid, or even of carbonic acid, it develops gaseous sulphurous acid and free sulphur, and the same phenomenon may possibly also occur in the stomach and in the tissues, in case the salt becomes reformed in passing through the latter. The *dose* is from gr. x.—lx. in aqueous solution, three or four times a day. [Externally the hyposulphite is a valuable parasiticide of the minute fungi of

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* By artificial septicæmia is meant the condition produced by injecting septic fluids into an animal's veins.

pityriasis versicolor, tinea tonsurans, &c., as a lotion (1 : 10 water). Both the hyposulphite and the sulphite of soda (*Sodii Sulphis*, U.S.) have been prescribed with success in gastric fermentation, accompanied with *sarcinæ*. *Dose*, of sulphite of soda, gr. v.—xx., and upwards.

Potassii Sulphis, *Sulphite of Potassium*. Is also officinal, U.S. *Dose*, gr. v.—x.]

Acidum Phosphoricum Dilutum (H_3PO_4).

A 10 per cent. solution of anhydrous phosphoric acid (sp. gr. 1·080; U.S., 8 per cent., sp. gr. 1·056). Phosphoric acid has a milder taste than the other mineral acids, and does not coagulate albumen at all. It can act as an efficient substitute for hydrochloric acid in the process of gastric digestion (Brücke); hence it is tolerated in febrile conditions in relatively large doses.

Two cubic centimetres of a 4 per cent. solution, when given internally to a frog, produced a distinct increase in the frequency of the pulse; and the same effect was produced by moistening the frog's heart with the acid after its removal from the body (Leyden and Munk). A dose of 15 grammes of phosphoric acid taken by a healthy man raised the pulse from 70 to 90, and afterwards reduced it to 66; at the same time he had a severe rigor, which was, however, soon afterwards followed by a pleasant feeling of warmth (Bobrik).

The *dose* is ♏x.—xxx., diluted with water. The acid is often given with some bitter infusion.

Acidum Hydrochloricum, B.P. (HCl).

Hydrochloric acid, Acidum Muriaticum, U.S. Usually prescribed as *Acidum Hydrochloricum* (*Muriaticum*, U.S.) *Dilutum*. The strong acid diluted to sp. gr. 1·052, B.P.; 1·038, U.S. [The strong acid is sometimes used externally with equal parts of water or honey, to destroy diphtheritic patches in the pharynx.] Hydrochloric acid is used for almost exactly the same purposes as sulphuric acid. Owing to its normal relation to gastric digestion, its administration is especially adapted to that form of dyspepsia which is accompanied with heartburn and flatulence, and which depends upon a deficiency of gastric juice, or on the presence of abnormal products of decomposition in the stomach. It is also useful in the dyspepsia of fever, in which, according to Manasseïn, there is no deficiency in pepsin, but rather in the normal quantity of free acid in the gastric juice. Pepsin is only efficient in the presence of acids; and since the latter enter into the composition of the peptones, they require to be renewed from without when the mucous membrane fails to secrete them in sufficient quantities. Hydrochloric acid alone can (according to Wolffhügel) slowly dissolve boiled fibrin, if digested with it at a temperature of 40° Cent., and convert it into peptone without the help of pepsin.

3·75 grammes of hydrochloric acid caused a considerable rise in the systolic elevations of the sphygmographic tracing, and well marked dichrotism. The pulse was hard and tense, and its frequency rose from 70 to 76, and then fell to 66 in a minute (Bobrik).

Use.—(1.) In most forms of dyspepsia. (2.) In diarrhœa. (3.) In inflammatory conditions, *e.g.*, in "bilious" pneumonia (Traube). [(4.) In convalescence from acute exhausting diseases (Leube).] *Dose,* ♏x.—xxx.; generally with infusion of calumba or gentian.

Pepsin.—Owing to the probability that Pepsin acts in the form of hydrochlorate, we may here say a few words with regard to it. It is a light yellowish brown powder, with a faint odour and slightly alkaline taste, prepared from the fresh mucous membrane of the stomach of the pig, sheep, or calf. It readily dissolves in water and alcohol. The *dose,* B.P., is gr. ij.—v. in pill with glycerin.

[The *Pepsine Boudault* (Paris), keeps better than the B.P. preparation, owing, *inter alia*, to the removal of the epithelium of the mucous membrane.] The Pharm. Germ. orders *Vinum Pepsini*, a clear liquid, extracted from the stomach by glycerin with the addition of 0·4 per cent. of hydrochloric acid, and diluted with sound white wine. It appears to be a very constant preparation. Of late, it has been much prescribed in the dyspepsia of hand-fed infants.

The following drug may be regarded as a derivative of hydrochloric acid:

Chlori Liquor, B.P., Aqua Chlorinii, U.S.

A solution of chlorine in half its volume of water. It is a gastric irritant if not given with caution. There can be scarcely any doubt that it is converted into hydrochloric acid in the stomach, and that in so doing it, as theory indicates, liberates oxygen. It was formerly much prescribed in febrile infectious diseases. [It has been used as a gargle in putrid sore throat, &c., and externally to purify foul wounds and ulcers.] *Dose*, ♏x.—xx. well diluted.

Acidum Nitricum (HNO_3).

Nitric Acid of sp. gr. 0·420, only used externally as a caustic (Vide *infra*, *Cauteria*). Internally it is prescribed in the form of *Acidum Nitricum Dilutum*, an aqueous solution containing 15 *per cent.* of anhydrous acid, sp. gr. 1·101. The U.S. *Acidum Nitricum Dilutum* is weaker, and has the sp. gr. 1·068. *Dose*, ♏x.—xxx., B.P.; ♏xv.—xl., U.S. Nitric acid is seldom used in Germany; in England it is prescribed for the most various imaginary and actual diseases of the liver.

Occasionally it is given in Germany in catarrhal jaundice, and it is possible that it may exercise a contractile influence on the *ductus choledochus* in this disease. It is also said to be of service in Bright's disease, when given with caution. The combination of nitric and hydrochloric acids in the form of

Acidum Nitrohydrochloricum Dilutum, B. P.

Nitromuriaticum Dilutum, U.S., *Dilute Nitrohydrochloric Acid*, is supposed to have a still more powerful effect on the liver. [It really stimulates the hepatic cells, and increases the flow of bile (Rutherford and Vignal, also Wood).] The *dose* is ♏v.—xx., freely diluted. The mixed acids are also used externally in jaundice in the form of a bath which contains ℥ viij. in a gallon of water.

VEGETABLE ACIDS.

The action of the vegetable acids is closely related to that of the mineral acids. Although, however, the former are so frequently employed, their properties are still only incompletely examined. When administered as such, a small portion of them passes unaltered into the urine, while if given as neutral alkaline salts they undergo almost complete combustion within the body (Wöhler), in which case they reappear in the urine as carbonates. They render the urine alkaline, and give rise to a precipitation of earthy phosphates in it. They are often excreted in the motions during the diarrhœa which their own presence excites. Their effect in rendering the urine alkaline is less marked if much animal food is simultaneously ingested.

The cooling effect of free vegetable acids is probably partly dependent on a lowering of the alkalinity of the animal juices. Bobrik took 7·5 grammes of acetic acid well diluted at one dose, and observed a distinct fall of nearly 1° Cent. in the temperature, diminished frequency of the pulse, and a distinct flattening of the summit of the sphygmographic tracings. The temperature fell from 38 to 35·15 after the injection of 7 c.c. of dilute acetic acid into a rabbit's stomach, and the same result followed the injection of citric and tartaric acids.

In the febrile human subject their beneficial effect is probably due, partly to the subjective sensation excited by their quenching the thirst, and partly to the quantity of water which is simultaneously introduced into the system, as well as to the diaphoretic effect of the latter.

The *use* of vegetable acids in internal diseases is chiefly restricted to their administration in the form of effervescing mixtures.

The *carbonic acid gas* (we are here only speaking of a solution of the gas in water), which is often supplied to the system therapeutically by administering compounds of vegetable acids with alkalies, or in the form of natural and artificial mineral waters, probably possesses certain definite physiological properties, which, although they are most likely not very powerful in a single dose, may exercise a decided effect when frequently repeated.

Carbonic acid appears to stimulate the digestion and also the absorbent power of the intestine, but it is still uncertain whether it has a directly stimulating effect upon the nervous centres when given in the above-mentioned forms.

Experience has proved that obstinate vomiting can be alleviated by liquids containing carbonic acid, provided there is no serious organic disease of the stomach. They slightly reduce the temperature, and the frequency of the pulse, and during their use the urine often contains an abnormal quantity of oxalic acid, a product of imperfect combustion. These effects must also be due to the property which carbonic acid has of diminishing the alkalinity of the animal juices, for the blood can be rendered acid by saturation with this gas after withdrawal from the body. It is also possible that the transitory fall of temperature which it produces depends on a reflex stimulus imparted to the nervous centres, similar to that produced by irritation applied to the skin. Its effect on the pulse and temperature persists as long as the urine, a product of tissue changes which are controlled by carbonic acid, contains an abnormal amount of this gas; hence it increases for from half to two hours after tolerably strong doses of the latter, and can probably be prolonged by its continued administration in small doses (Kerner).

The stimulating effect exerted on the skin by mineral waters containing carbonic acid appears to depend upon the salts, and not upon the gas dissolved in them (Zuntz and Paalzow); while, according to another authority (Röhrig) carbonic acid is directly absorbed by the skin from the water of the bath.

Preparation:—

Aqua Acidi Carbonici, U.S. (Water impregnated with about five times its bulk of carbonic acid.) *Dose, ad libitum.*

Acidum Aceticum ($C_2H_4O_2$).

This is no vegetable acid in the ordinary sense, since it is indirectly prepared from vegetable substances during the process of fermentation, and by destructive distillation.

The following preparations of it are officinal:—

(1.) *Acidum Aceticum.* (Ordinary acetic acid, containing 28 per cent. of anhydrous acid, B.P.; 30·6 per cent., U.S.) [It is only used for preparing the following drugs: *Acetum Cantharidis*, *Extractum Colchici Aceticum*, *Linimentum Terebinthinæ Aceticum*, *Liquor Ammoniæ Acetatis*, *Liquor Epispasticus*, *Oxymel*, &c.]

(2.) *Acidum Aceticum Dilutum*, B.P. (1 in 8.) *Dose*, ʒj.—ij. [Used internally and also to prepare *Acetum Scillæ*, and *Liquor Morphiæ Acetatis.* It has been employed with success as an injection into glandular swellings in the neck in doses of from ♏v.—xx., once a week (Morrell Mackenzie).]

(3.) *Acidum Aceticum Glaciale*, B.P. It is chiefly used externally as a caustic [especially to warts. It is contained in *Acetum Cantharidis* and *Mistura Creasoti.*]

(4.) *Acetum.* Vinegar containing 4·6 per cent. of anhydrous acetic acid, and a trace of sulphuric acid (the U.S. Acetum contains no sulphuric acid).

Action.—In addition to what we have already said above, as to the effect of vinegar on the temperature, we may state that a foot bath, containing three large bottles of vinegar mixed with the water, reduced the frequency of the pulse, and also lowered the temperature in less than sixteen minutes. The tension of the radial artery diminished, and the pulse became small and threadlike (Bobrik). It is possible that when vinegar is used to wash large surfaces of the body, as it often is in fever, part of its effect may be due to the absorption of volatile substances from it by the skin.

The vapours of acetic acid paralyse low forms of life, and hence may be used in certain cases as a disinfectant, in the same way as sulphurous acid and chlorine.

Acidum Citricum ($C_6H_8O_7$).

Citric Acid, in the form of crystals. Its action is essentially the same as that of acetic acid. Large doses slightly increase the quantity of the urine as well as its acidity, and are excreted in it partly as such and partly in combination with lime. This acid has been given, in association with potash, in the form of fresh lemon juice, in acute rheumatism; and as lemon juice or lime juice it is the established remedy in scurvy. In ordinary practice it is mainly used as the acid ingredient of effervescing powders or mixtures, *e. g.*, 17 grs. with 20 grs. of bicarbonate of soda, 25 grs. carbonate of potash, or 15 grs. carbonate of ammonia. *Dose*, gr. x.—xxx.

[As preparations of Citric Acid may be considered :—

(1.) **Potassæ Citras,** B.P., *Potassii Citras*, U.S., *Citrate of Potash*. *Dose*, gr. xx.—lx. Useful where the remote action of carbonate of potash is desired.

(2.) *Liquor Potassii Citratis*, U.S. (Citric acid, ℥ ss.; bicarbonate of potash, gr. ccclx.; water, Oss.) *Dose*, ℥ j.—ij.

(3.) *Mistura Potassii Citratis*, U.S. Neutral mixture. (Lemon juice, Oss.; bicarbonate of potash sufficient to completely neutralise it.) *Dose*, ℥ ss.]

Acidum Tartaricum ($C_4H_6O_6$).

Tartaric Acid. Prepared from bitartrate of potash by decomposition with chalk. It is chiefly employed for making effervescing mixtures, of which the following are officinal in Germany and America :—

(1.) *Pulvis Effervescens*, English soda powder. (30 grs. bicarbonate of soda, 25 grs. tartaric acid; the former in a blue, the latter in a white paper.)

(2.) *Pulvis Effervescens Aperiens*, Aperient seidlitz powder. (Tartrate of soda and potash, 120 grs., bicarbonate of soda, 40 grs., in one paper; tartaric acid, 35 grs. in the other.) To be taken at one dose.

The following preparation is officinal, B.P. :—

Sodæ Citro-Tartras Effervescens. Effervescing citro-tartrate of soda. (Bicarbonate of soda, 17 pts., tartaric acid, 8 pts., citric acid, 6 pts., all in powder, heated to between 200° and 220° Fahr., so as to granulate.) *Dose*, gr. lx.—cxx.

CHAPTER X.

EVACUANTIA.

EMETICS, PURGATIVES, DIURETICS, DIAPHORETICS.

UNDER evacuant remedies I understand those drugs which empty the stomach by exciting vomiting, and the intestines by increasing their peristaltic action, which promote the liquefaction and escape of mucus from the bronchi, the excretion of urine by the kidneys, or the perspiration by the skin.

EMETICA.

The main purpose for which emetics are used is to empty the stomach, and sometimes also to promote the discharge of lumps of mucus which have accumulated in the upper part of the larynx, and the lower part of the pharynx. The trachea and the bronchi cannot expel their contents at the very moment of vomiting, the glottis being then firmly closed. Owing, however, to the shock, and to an increase of watery secretion from their mucous membrane, any tenacious mucus or false membranes present are loosened from their attachments, and can afterwards be more easily ejected by the movements of coughing. For the same reason the act of vomiting has no direct influence over foreign bodies lying in the air-passages, and it is only when they are impacted or otherwise fixed in a given spot that the energetic action of the abdominal muscles in vomiting can be of use by detaching them from their place. It is also supposed that the excretion of bile may be materially promoted, in a purely mechanical way, by the movement of the abdominal walls in vomiting, and that thus it may be possible to facilitate the expulsion of calculi or plugs of mucus from the bile ducts.

The frequency of the pulse increases from the commencement of nausea until the end of vomiting, but most rapidly at the commencement of the latter act. Immediately after its termination it falls considerably, but later on more slowly. The normal temperature undergoes no change. The respiration behaves in essentially the same way as the pulse; and so does (according to Traube) the arterial pressure (Ackermann).

The more general action of emetics in doses strong enough to excite vomiting, has not been as yet scientifically investigated. It was formerly characterised by the terms "revulsive, discutient, and abortive." Acute inflammations, *e.g.*, erysipelas and tonsillitis, often resolve after an emetic has been given, and the fever may decline as much as 2° Cent. (Traube).

The officinal emetics are:—

Antimonium Tartaratum, B.P., Antimonii et Potassæ Tartaras, U.S. ($K(SbO)C_4H_4O_6$).

Tartarated Antimony, *Tartar Emetic.* A double salt which dissolves with tolerable ease in water (1 in 20), but is insoluble in alcohol. Its *action* externally is that of a powerful irritant. When rubbed into the skin, either as a lotion or an ointment, it produces a pustular eruption upon it, and its caustic effect on the mucous membranes is still more rapid, and may excite severe inflammation in the stomach. Diarrhœa occurs after relatively small doses.

Internally in small doses it excites the symptoms above described as characteristic of nausea, and in large ones rapid and severe vomiting. According to the researches of Ackermann, it diminishes arterial pressure, and reduces the temperature, and in large doses it destroys the irritability of the cardiac muscles.

The act of vomiting is due to the direct stimulus of the drug on the gastric mucous membrane, and does not depend on its absorption, and subsequent action on the nervous centres.

The *uses* of tartar emetic can be readily deduced from its physiological properties. Thus it is employed (1.) as an emetic, especially in cases where a rapid and powerful effect is desired, and in the absence of any pre-existent gastric or intestinal irritation. It is also best avoided in the diseases of early childhood, owing to the constitutional tendency to severe intestinal catarrh at that period. (2.) As a symptomatic remedy in acute pneumonia, and bronchitis. [It is of great value in emphysema in lessening the accompanying bronchial catarrh (Wilks).]

Dose.—As an emetic, gr. j.—ij.; best given as a powder, or simply dissolved in water. In pneumonia as an antipyretic, gr. $\frac{1}{6}$—j. Vomiting and severe diarrhœa are readily produced in children even by small doses, and hence the greatest caution is necessary in its use. The following preparations of it are officinal.

(1.) *Vinum Antimoniale*, B.P., *Vinum Antimonii*, U.S. (Tartar emetic, gr. ij. sherry, ℥j.) *Dose*, ♏v.—xxx., or more according to the action required. The admixture with wine is intended to improve the flavour of the drug, and to prevent the occurrence of symptoms of collapse.

(2.) *Syrupus Scillæ Compositus*, U.S. (Squill, senega, tartar emetic, sugar, diluted alcohol; gr. j. tartar emetic in ℥j.) *Dose*, ♏v.—ix.

(3.) *Unguentum Antimonii Tartarati*, B.P., *Ung. Antimonii*, U.S. (Tartar emetic in fine powder, 1 pt., simple ointment, 4 pts.) In a few days it produces a pustular eruption upon the part into which it is rubbed, and hence acts as a powerful derivative in internal inflammations and in chronic mental affections (Nasse). The extent of its curative effect upon the products of inflammation has not as yet been scientifically determined.

(4.) *Emplastrum Antimonii*, U.S. (Tartrate of antimony and potassium, ℥j., Burgundy pitch, ℥iv., melted together.)

[The following drug resembles tartar emetic in its properties, but is less active:—

Antimonii Oxidum, B.P., U.S. (SbO_3), *Teroxide of Antimony*. *Dose*, gr. j.—iij.

Preparation:—

Pulvis Antimonialis, B.P., James's powder. (Oxide of antimony, 1 pt., precipitated phosphate of lime, 2 pts.) *Dose*, gr. ij.—vj. It is ordinarily prescribed as a "diaphoretic."]

Radix Ipecacuanhæ.

The dried root of *Cephaëlis Ipecacuanha* (Rubiaceæ), a native of several districts of South America. Its active constituent is an amorphous alkaloid *Emetin*.

The drug, if applied in a suitable form, exerts an irritating *action* on the skin deprived of its epidermis. Ipecacuanha powder also irritates the eyes if introduced into them. Internally, small doses only nauseate, while larger ones cause vomiting, which differs from that produced by equivalent doses of tartar emetic in its shorter duration, and in the smaller amount of general discomfort, and of local irritation of the mucous membranes, to which it gives rise. Hence ipecacuanha is the most suitable emetic for children and delicate persons, and also for cases where diarrhœa is present. Since, when given in moderate doses, it appears to liquefy the secretions of the air-passages and to excite gentle irritation in the pharynx, it is a good expectorant in certain cases. It is especially valuable in acute bronchitis, with fever and scanty, or almost completely suppressed, expectoration. Under its action the skin becomes moist (which alone must help to lower the fever), and the dry swelling of the bronchial mucous membrane is succeeded by a much less irritating state of gentle secretion. Nothing definite is known about its much lauded "anti-spasmodic" properties, as it has usually been the custom of medical men to give it in combination with other similar drugs. It has a great reputation among many physicians as a specific in dysentery, especially in large doses. [Some cases of obstinate hæmoptysis have yielded, at any rate temporarily, to nauseating doses of ipecacuanha.]

Dose.—As an emetic, gr. xv.—xxx. in powder. As an expectorant, or antispasmodic, gr. ss.—ij.

Preparations:—

(1.) *Vinum Ipecacuanhæ.* (Ipecacuanha, 1 pt., sherry, 20 pts.) *Dose*, ♏v.—xl. as an expectorant; ʒ iij.—vj. as an emetic. The U.S. preparation is made with fluid extract of ipecacuanha (1 to 15). *Dose*, ʒ j.—℥ ss.

(2.) *Extractum Ipecacuanhæ Fluidum*, U.S. (Ipecacuanha, stronger alcohol, glycerin, diluted alcohol, water; Oj. extract is prepared from ℥ ij. ipecacuanha.) *Dose*, ♏ij.—lx.

(3.) *Pilula Ipecacuanhæ cum Scillâ*, B.P. (Dover's powuer, squill, ammoniacum; 3 pts. Dover's powder in 7.) *Dose*, gr. v.—x.

(4.) *Pulvis Ipecacuanhæ Compositus*, B.P., U.S. Dover's powder. (Ipecacuanha, 1 pt., opium, 1 pt., sulphate of potash, 8 pts.) *Dose*, gr. v.—x., or more.

(5.) *Trochisci Ipecacuanhæ.* (B.P. and U.S. both $\frac{1}{4}$ gr. in each lozenge.) *Dose*, 1—3 lozenges.

(6.) *Trochisci Ipecacuanhæ et Morphiæ.* (B.P. $\frac{1}{12}$ gr. ipecacuanha, $\frac{1}{36}$ gr. hydrochlorate of morphia; U.S. $\frac{1}{12}$ gr. ipecacuanha, $\frac{1}{40}$ gr. sulphate of morphia, in each lozenge.) *Dose*, 1—6 lozenges.

(7.) *Syrupus Ipecacuanhæ*, U.S. (Fluid extract of ipecacuanha, syrup; 1 to 15.) *Dose*, ʒj.—℥ss.

Cupri Sulphas, B.P., U.S. ($CuSO_4$).

Sulphate of Copper. Beautiful blue crystals readily soluble in water.

It is a powerful caustic. It causes vomiting when taken internally, probably by its corrosive effect on the stomach. On the whole it is inferior to tartar emetic and ipecacuanha, and if it is true that vomiting can be more rapidly excited by large doses of sulphate of copper than by the former drugs, this gain is probably only obtained at the expense of the gastric mucous membrane. It is still occasionally ordered as an emetic for children in doses of from gr. ss.—iss., twice repeated at short intervals. The emetic dose for an adult is gr. v.—x.

Sulphate of copper has been recommended as an antidote for phosphorus (Bamberger). Pieces of phosphorus immersed in a solution of the sulphate rapidly become coated with metallic copper, beneath which a layer of phosphide of copper is formed. Carbonate of copper is still better adapted for this purpose, being less readily vomited up. The dose would be from 0·25—0·50, followed by the administration of vinegar, in order to dissolve it slowly.

Apomorphia ($C_{17}H_{17}NO_2$) (Not Officinal).

A new emetic, formed by strongly heating morphia with fuming hydrochloric acid in a sealed tube (Matthiessen). It is morphia *minus* the elements of water, and is a basic substance which, both when uncombined, as well as when in the form of hydrochlorate, soon turns green on exposure to the air. It produces vomiting in men when injected subcutaneously in doses of 0·005—0·01 gramme ($\frac{1}{13}$—$\frac{1}{6}$ grain). Its action depends on direct irritation of the "nervous centre for vomiting," which is situated in the *medulla oblongata.* Its emetic effect is checked by chloroform or chloral, and increased by morphia. We may say in passing that large doses of it paralyse the striped muscles (Harnack). It accelerates the pulse and respiration. It should be used with caution, as cases have been reported in which it caused sudden collapse and death.

The best preparation of it is the *hydrochlorate*, which forms beautiful crystals, and quickly and completely dissolves in tepid water. It turns dark green under the action of light, but does not lose its efficacy in consequence. It should be prescribed in a *coloured* bottle, and a few drops of dilute hydrochloric acid should be added to the solution to make it keep.

Apomorphia also belongs to the class of

EXPECTORANTIA.

Expectorants.

Those drugs, by which we promote the escape of secretion from the trachæa and its branches, may act in one of two ways. If these parts are inflamed, swollen, and tense, as we not unfrequently find to be the case with such mucous membranes as are capable of direct observation, or if they are coated with tenacious mucus, it is possible under certain circumstances to excite an increased secretion of watery fluid from their surface, and thus to reduce the swelling and tension, and to render the mucus liquid and loose. If, on the other hand, the bronchial walls are relaxed, and their muscles, in conjunction with other expiratory muscles, are no longer strong enough to expel the secretion, we are sometimes able by internal medicines to rouse their secreting tissues into greater activity.

Hydrochlorate of Apomorphia

Must be ranked with those expectorants which increase the secretion of the bronchi by directly stimulating the nervous system.

It is used with good effect where the expectoration is tough and adherent, whether in simple inflammations of the larynx, trachæa, and bronchi (Jurasz), or in catarrhal pneumonia (Jürgensen). The expectoration, it is true, becomes more copious, but it is looser, and the condition of the patient is improved thereby. The râles, which were at first dry and sibilant, become moist and soft, and the disease itself tends towards recovery. The *dose* as an expectorant is from gr. $\frac{1}{6}$—ss. *t.d.s.* in solution, or gr. $\frac{1}{65}$—$\frac{1}{6}$ *secundis horis.* The nausea which it at first causes soon passes off (Jurasz).

Another class of expectorants in considerable use, namely, antimonial preparations, not only act like apomorphia but have a sedative effect as well. The one which is most used in Germany is

Antimonium Sulphuratum (Sb_2S_5).

Golden Sulphide of Antimony. It is supposed to unite the properties of sulphur and antimony. The latter consists, as far as the air-passages are concerned, in depressing the function of the sensory portions of the spinal cord. The irritation of repeated coughing, which only aggravates the pre-existing catarrh, is relieved by the drug, because it interferes with the transmission of the sensation of hyperæsthesia, originating in the peripheral sensory nerves, through the spinal cord (Radziejewski). It is also said to liquefy tenacious mucus by increasing the excretion of serous fluid from the mucous membrane. It also lowers the action of the heart.

Use.—It is given in acute catarrh of the air-passages in doses of gr. ¼—iss., several times a day in powder or pills.

Antimonium Sulphuratum (Sb_2S_3). *Tersulphide of antimony* is officinal, B.P., U.S., but very little used except as an ingredient in *Pilula Hydrargyri Subchloridi Composita*, Plummer's pill. *Dose*, gr. j.—v.

Antimonium Nigrum (Sb_2S_3), B.P., U.S., the native sulphide, is only used for preparing the other salts of antimony, and for making sulphuretted hydrogen.

Antimonial preparations must not be given continuously for a long period, since, like phosphorus and arsenic, they cause fatty degeneration of various tissues, and especially of those of the liver.

I subjoin some observations on certain salts which are credited with expectorant properties. Chloride of sodium, or carbonate of soda, is the most important ingredient in many mineral waters, *e.g.*, those of Ems, Neuenahr, Aachen, Tarasp, [Vals, Vichy,] &c.

Mucus contains more carbonate of soda than the blood, and its physical properties are affected by the presence of this salt in varying proportions. Mucus which is rich in salt is more readily detached from the mucous membrane than that which contains but little of it (Buchheim). The curative effect is probably due (1) to the fact that the alkaline soda salt neutralises those irritating acid products which are formed if the mucus remains unexpelled from the body; (2) to the favourable effect of both salts on the formation and nutrition of healthy epithelium; (3) to a purely chemical improvement of the functional activity of the muscles. The same is true of

Ammonii Chloridum, B.P., U.S. (NH_4Cl).

Chloride of Ammonium, Sal Ammoniac. The most poisonous preparation of ammonia when administered in large doses (cf. page 62). A salt of unpleasant taste, which is given internally in doses of gr. v.—xx. (Extract of liquorice covers the taste more efficiently than any other corrective. The addition of syrup makes chloride of ammonium as well as most other medicines more disagreeable than before.) It is sometimes brought into direct contact with the air-passages in the form of an inhalation. About 3 grammes are gently heated in a porcelain evaporating basin over a spirit lamp, and the patient not only inspires the vapour as it rises, but remains for some time in the atmosphere of sal ammoniac which fills the room. Sal ammoniac may also be inhaled in the *nascent* state, by placing a watch glass containing hydrochloric acid in a saucer, and pouring some caustic ammonia into the latter. White vapours are immediately formed, and can be conveniently inhaled as they rise. In suitable cases such inhalations do good service. [In some cases of neuralgia of the fifth nerve, especially when originating in dental *caries*, a few 20-grain doses of chloride of ammonium, repeated every hour or two hours, are very effectual, but it is useless to continue them if no effect is produced after three or four doses. Sometimes the remedy absolutely fails.]

Chloride of ammonium is used for preparing *freezing mixtures*, in cases where no ice, or sufficiently cold water, is available. Seven pts. of the chloride, 7 pts. of saltpetre, and 11 pts. of sulphate of soda in crystals, when mixed with 22 pts. by weight of water at a temperature of 10° Cent., will produce a temperature of — 10° Cent. if properly managed. A still better plan is to dissolve finely crushed *nitrate of ammonia* in an equal weight of water; the temperature falls lower than in the previous method, and there is the additional advantage of being able to recover the salt for further use by simply evaporating to dryness.

The inhalation of an aqueous solution in the form of spray may be recommended as a good method of employing the non-volatile expectorant salts, as there is much more likelihood of producing a local effect by this means than by their administration by the stomach.

The vapours which are produced by burning the

Charta Nitrata, PHARM. GERM.,

Saltpetre Paper, may be considered here. It consists of unsized paper, which has been dipped in a concentrated solution of nitrate of potash, and dried. Lighted pieces of it are placed in a suitable vessel, from which the smoke is inspired. Many patients find benefit from this inhalation in asthma due to chronic degenerative changes in the bronchi.

It has been stated by Vohl, that when saltpetre paper is burnt, carbonic oxide, cyanogen, ammonia, nitrogen, carbonate and nitrate of potash, and water, are formed and volatilised. The carbonates of potash and ammonia are most abundantly present, the former being mechanically carried up and suspended in the smoke.

The stimulating compounds of ammonia belong to the second class of expectorants, which as previously stated produce their effect by their influence on the bronchial muscles. Those which are chiefly used are the *carbonate* and the *succinate*, Pharm. Germ. At present our knowledge of their actual value as expectorants is purely empirical. This is also true of those drugs whose action is supposed to depend on the presence of an *æthereal oil.* When absorbed from the stomach into the circulation, it is possible that the latter may come into contact with the diseased mucous membrane of the air-passages; nothing more definite, however, is known with respect to them.

The æthereal oils enter into the composition of many expectorant medicines, of which the *Tinctura Camphoræ Composita* and *Pulvis Glycyrrhizæ Compositus* are officinal B.P., U.S.

The following drug is much used as a stimulating expectorant:—

Senegæ Radix.

Senega Root. Derived from Polygala Senega, growing in the southern districts of North America. The root contains a pulverulent glucoside, *Senegin*, which has an acrid taste, and is soluble in boiling water, and in alcohol. It is identical with Saponin, extracted from Saponaria Officinalis, and with Githagin obtained from Agrostemma Githago—the *common Corn Cockle.* It has an irritating effect on the mucous membranes, and when given to men in doses of 0·02—0·2 it preduces a sensation of roughness in the throat, an inclination to cough, and an increased secretion of mucous in the air-passages. In large doses it causes death in the same way as the irritant narcotics; when locally applied it paralyses both the muscles and the nerves (Pelikan). If a trace of Senegin be introduced into the air-passages in the form of spray, it is said to cause a prolonged feeling of substernal irritation (Schroff). No other investigations of its mode of action have as yet been made, and its reputation is based on purely empirical grounds. The *dose* of the powder is gr. xv.—xx., but it is most generally administered as one of the following preparations:—

(1.) *Infusum Senegæ*, B.P. (Senega, 1 pt., boiling water, 20 pts.) *Decoctum Senegæ*, U.S. (1 in 16.) *Dose*, ℥ j.—ij.

(2.) *Tinctura Senegæ*, B.P. (Senega, 1 pt., proof spirit, 8 pts.) *Dose*, ʒ ss.—ij.

(3.) *Syrupus Senegæ*, U.S. *Dose*, ʒ j.—ij.

In Germany the following drug also enjoys considerable reputation:—

Acidum Benzoicum ($C_7H_6O_2$).

Benzoic Acid. Obtained by subliming the *resin* of Styrax Benzoin, a tree growing in the East Indian Islands. The resin is a reddish-brown mass, with an odour like vanille. Both it and the acid are officinal. The latter, as can be easily perceived by the smell of the crystals, contains æthereal and aromatic constituents in addition to the acid itself, and it probably owes its efficacy to them. The pure acid, when given in ordinary doses, passes through the body without exerting any special influence on it (Kerner), and after taking up the elements of glycocoll, appears in the urine in the form of hippuric acid.

Benzoic acid—even when quite pure—is strongly antiseptic (Salkowski).

Nothing is known as yet about the *rationale* of its expectorant action.

Benzoic acid is prescribed for the same purposes as senega.

Its dose is from gr. iij.—viij. several times a day. It is contained in the *Tinctura Camphoræ Composita* and the *Tinctura Opii Ammoniata.*

[Benzoic acid is sometimes given in cystitis with a view to acidify the urine. For this purpose, at least ten or twelve 3-grain pills must be given *pro die* (H. Thompson). It has been also recommended to check uræmic vomiting; 1 grain every two hours (Oppolzer).

The following preparations of Benzoin are officinal:—

(1.) *Tinctura Benzoini Composita,* Friar's balsam, B.P., U.S. (Benzoin, storax, balsam of tolu, socotrine aloes, rectified spirit; 1 in 10.) *Dose,* ʒ ss.—ij. Occasionally used in chronic bronchitis, and also externally as a stimulant to sluggish wounds. A piece of lint dipped in it is the best material for sealing recent wounds, *e.g.*, in compound fractures (Bryant). ʒ j. inhaled from the surface of hot water is of service in acute laryngeal catarrh (Morrell Mackenzie).

(2.) *Adeps Benzoatus,* B.P. (Benzoin, gr. x., lard, ℥ j.) The *Unguentum Benzoini,* U.S., consists of benzoin, 1 pt., lard, 6 pts.

(3.) *Tinctura Benzoini,* U.S. (Benzoin, alcohol; 1 in 5.) *Dose,* ʒ ss.—j.

(4.) **Ammoniæ Benzoas.** (Benzoate of ammonia, B.P., U.S.) *Dose,* gr. x.—xx. Like benzoic acid it appears in the urine as hippuric acid. Used in cystitis.]

The next drug agrees with benzoic acid in its reputed medical properties.

Acidum Succinicum, *Succinic Acid* ($C_4H_6O_4$). Obtained by the dry distillation of amber. It is given in doses of from gr. ivss.—vij. in powder, pills, or in combination with ammonia. The U.S. Pharm. has an *Oleum Succini rectificatum,* made by distilling crude oil of amber with water. *Dose,* ♏ v.—xv.

In accordance with the analogy of benzoic acid, and other allied bodies, it is conceivable that if amber really has an expectorant action it is due to the oil which adheres to the acid and not to the latter itself, the pure acid when present in the blood being probably without any effect whatever on the air-passages.

PURGANTIA.

PURGATIVES.

The remedies which cause evacuation of the bowel may conveniently be divided into two classes, the *Eccoproctics*, which simply increase the peristaltic action of the intestines, and thus lead to removal of their contents, and the *Drastics*, which are generally employed with a view to excite a greater or less degree of irritation of the mucous membrane, but which in many cases are prescribed for the same purpose as the members of the first group. It is clear, however, that this division is merely a relative one, since an eccoproctic readily becomes a drastic when given in large doses, and the reverse is the case if the latter be administered in small doses. If we begin with the mildest purgatives and gradually ascend to the stronger and more active ones, without making any marked divisions between them, we shall have the series given below, in which the individual members are grouped as much as possible in accordance with the general agreement of their properties.

All purgatives that have been specially examined with regard to this point have been found to increase the absolute quantity of bile secreted for a certain period. This effect is always preceded by a considerable amount of hyperæmia of the intestine. It also occurs if such hyperæmia be excited by other causes (Röhrig).

Later researches (*vide* p. 255) confirm the fact that purgatives withdraw a large quantity of liquid from the blood. From this fact Brunton draws the conclusion that they lower the blood pressure in other parts of the vascular system, and hence may be used with advantage to reduce acute œdema of various tissues. The fact that the sphygmographic tension of the radial artery is diminished under the influence of purgatives (Mahomed) is in accordance with this view.

Serum Lactis, PHARM. GERM.

Whey. Prepared by separating the serum from the casein of milk by the action of rennet. It is a liquid of a sweetish taste, which contains the sugar of milk, the greater part of the salts, and the albumen. Its main action is purgative; the numerous other properties which have been ascribed to it are probably due entirely, or in the main, to the favourable conditions (mountain air, open-air exercise, removal from unhealthy influences, &c.) under which the whey cure is generally carried out. It is said that the whey also promotes the renal secretion.

Generally several glasses of warm whey are drunk each day, but the exact quantity varies very much with the individual. Besides the simple *Serum Lactis* the following preparations are occasionally used:—

(1.) *Serum Lactis Acidum,* in which the casein is precipitated by bitartrate of potash, instead of by rennet.

(2.) *Serum Aluminatum,* similarly prepared with alum.

(3.) *Serum Lactis Tamarindinatum,* in which tamarind juice is the reagent used. The difference in the action of each of these liquids will be evident from the nature of their ingredients.

The coagulation of milk does not depend on the formation of free lactic acid, for the latter has no effect in liberating the casein until the milk is completely acid, and the rennet may be added, and coagulation produced, without the occurrence of any acid reaction (Heintz).

Tamarindus.

Tamarind Pulp. Prepared from Tamarindus Indica (Cæsalpiniaceæ), a West Indian tree. It has a dark brown colour, and a not unpleasant acid, and rather rough taste. Its active constituents are the tartaric, malic, and citric acids. It can easily be replaced by fresh or dried native fruits, if necessary, with the addition of some cream of tartar. The *dose* is ℥ ¼ or more. [It is also contained in *Confectio Sennæ.*]

[Rosæ Centifoliæ Petala.

Cabbage Rose Petals, B.P., *Pale Rose Petals,* U.S. The fully expanded blossoms of Rosa Centifolia have mild aperient properties, but are chiefly used as

Aqua Rosæ, Rose Water. (Fresh petals, 1, water, 2, distil., 1, B.P.; petals, ℥ xlviij., water, Oxvj., distil., Oviij., U.S.) *Dose,* as a vehicle for other medicines, ℥ j.—ij., and upwards.

Ficus, B.P., U.S.

Fig. The dried fruit of Ficus Carica (Urticaceæ), from Asia Minor, is contained in *Confectio Sennæ.* Any aperient action it may possess is very trifling.

Prunum, B.P., U.S.

Prune. The dried fruit of Prunus Domestica (Amygdaleæ), from Southern Europe. A very mild aperient. Chiefly used as a household medicine stewed in syrup, or soaked in olive oil. *Dose,* ℥ ij., or more. An ingredient in *Confectio Sennæ.*]

Manna.

Manna. The dried juice of Fraxinus Ornus (Oleaceæ), which is specially cultivated for the purpose in Southern Italy. The manna flows from incisions in the bark, and forms yellowish-white masses. The best kind is known as *Manna electa.* It has a sweet taste, and its principal constituent is Mannite ($C_6H_{14}O_6$), a body which is chemically allied to grape sugar.

Manna is not well tolerated in cases of dyspepsia. The *dose* is ℥ ¼—j., either in aqueous solution or as an electuary.

Potassæ Tartras Acida, B.P. ($KC_4H_5O_6$), **Potassii Bitartras,** U.S.

Bitartrate of Potash, Cream of Tartar. Soluble in 180 pts. of cold water. It is obtained from the sourer kinds of wine, and is deposited in an impure state on the insides of the casks in which they are stored. Within the body, the tartrate is converted into carbonate of potash, and being excreted as such by the kidneys, renders the urine somewhat alkaline. The bitartrate also, which excites diarrhœa in its passage through the bowels, is gradually converted into the carbonate (Buchheim). It acts as a gentle aperient in doses of ʒ j.—ij.; in doses of ℥ ss.—j. it is a hydragogue purgative. [It is contained in *Confectio Sulphuris* and *Pulvis Jalapæ Compositus.*]

Potassæ Tartras ($K_2C_4H_4O_6$), *Tartrate of Potash,* readily soluble in water. It has mild purgative properties, and in non-aperient doses it is reputed to have a special "alterative" action on the liver and spleen, and also to relieve "congestions" of these organs. It is also said to promote the secretion of bile, and in proportion to the dose it renders the urine alkaline. It is prescribed as an alterative in doses of gr. xx.—lx.; as a purgative in doses of gr. cxx.—cc. Extractum Glycyrrhizæ is a good corrective of its unpleasant taste.

Soda Tartarata, B.P. ($KNaC_4H_4O_6$), *Potassii et Sodii Tartras,* U.S., *Tartrate of Soda and Potash, Rochelle Salt,* is a readily soluble mild aperient. When given in repeated small doses it also appears to have a diuretic action. *Dose*, ʒ ij.—iv.

[It is an hepatic stimulant (Rutherford and Vignal).]

Sodæ Sulphas (Na_2So_4), B.P., U.S.

Sulphate of Soda, *Glauber's Salt.* This salt, like other similar combinations, can be reduced in the intestine to the form of sulphide, and the latter in its turn can undergo decomposition in the presence of acids with the formation of sulphuretted hydrogen.

The well-established success of the Carlsbad waters in the treatment of various abdominal diseases, and especially in the prevention of the cholesterin concretions known as gallstones, [and also of renal calculi (H. Thompson)], as well as their efficiency in diabetes, allow us to assume that sulphate of soda has some special influence on tissue changes. [According to Rutherford and Vignal it slightly increases the biliary secretion.] The solid residue of the Carlsbad Sprudel contains more than half its weight of Glauber's salt, associated with about a quarter of its weight of carbonate of soda, and one-fifth of chloride of sodium. The whole residue is often prescribed in teaspoonful doses in warm water under the title of *Sal Thermarum Carolinense.*

It seems paradoxical that sulphate of soda should render good service in tropical dysentery. Here it is given in doses of 15—20 grammes in the twenty-four hours divided into four portions. Its action may possibly be explained as follows:—Sulphate of soda does not readily diffuse into the blood, and hence passes far down the intestine unabsorbed. Here it meets with the infectious ferments which cause the disease, and is reduced by them with the development of that powerful disinfectant nascent oxygen.

Sodæ Phosphas (Na_2HPO_4), *Phosphate of Soda.* A readily soluble salt of alkaline reaction, and not unpleasant taste.

When introduced into the system in large quantities, it may possibly affect the composition of the blood. It has the property of absorbing carbonic acid, and of again evolving it if heated, or if the pressure be diminished. Its property of dissolving more uric acid than most other salts, may also possibly be turned to a therapeutic use. Nothing more definite, however, is known about the bearing of these facts, or the effect of an increased supply of phosphate of soda to the system. At present this salt has scarcely any importance except as a mild and agreeable purgative. [It is an hepatic stimulant of considerable power, rendering the bile more watery, and increasing the amount of biliary matter secreted. Its irritant action on the mucous membrane of the bowel is very slight (Rutherford and Vignal).] The dose is from ℥ ss.—j.

Pyrophosphate of Soda ($Na_4P_2O_7$) is also officinal in Germany, but care must be taken not to order it in large doses, since (according to Gamgee's recent researches), it is a cardiac poison, like all other salts of pyrophosphoric acid.

Magnesiæ Sulphas ($MgSO_4$).

Sulphate of Magnesia is, in spite of its unpleasant bitter taste, largely used as a purgative. Part of the sulphuric acid is withdrawn from it in the bowel by the potassium and sodium salts which it meets with there, while its magnesia is almost completely excreted in the motions in partial combination with decomposed biliary products (Buchheim). [It has no cholagogue action (Rutherford and Vignal).] The *dose* is ʒ ij.—iv. It is contained in *Mistura Sennæ Composita*, and in the following preparation:—

Enema Magnesiæ Sulphatis, B.P. (Sulphate of magnesia, ℥ j., olive oil, ℥ j., mucilage of starch, ℥ xv.); to be injected at one dose.

Magnesiæ Citras, Citrate of Magnesia, is officinal as *Liquor*

Magnesiæ Citratis, B.P. (Carbonate of magnesia, citric acid, syrup of lemons, bicarbonate of potash, water). It is preserved in firmly corked bottles like soda water. *Dose*, ℥ v.—x.

Liquor Magnesii Citratis, U.S., is almost identical with the above. *Dose*, ℥ xij. Citrate of magnesia is a pleasant aperient.

Lactate of Magnesia is highly praised by some German physicians. *Dose* 10—12 grammes as a purgative.

The endosmotic equivalent of most of the above salts is relatively high, and it was formerly thought, on the authority of Liebig, that the passage of serum from the blood into the bowel was due to endosmosis, and that such a passage was an essential feature in the phenomena of diarrhœa. The following facts, however, may be adduced in opposition to this view:—(1) that saline solutions purge equally well, whether dilute or concentrated, provided they enter the bowel in sufficient quantity; (2) that if an artificial fistula be made in the bowel by Thiry's method, and sulphate of soda be simultaneously administered, the latter does not excite a flow of serum into the bowel, but only increases its peristaltic movements; and (3) that Radziejewski's chemical analysis of the motions which purgatives induced proved that they were, as a rule, not of a serous nature at all, but only consisted of the contents of the intestine. Liebig's view receives good support from some more recent experiments on animals (Moreau, and Brunton), in which three similar portions of contiguous intestine were separated by ligature, and some drug, such as sulphate of soda, elaterium, gamboge, or croton oil, was injected into one of them, and the whole replaced into the abdominal cavity. On afterwards comparing together the quantity of liquid which each loop of intestine contained, it was found that a copious transudation of watery fluid had taken place into that portion into which the purgative had been injected.

This much, at any rate, is certain, that the properties of purgative salts are partly due to their slight diffusibility, for otherwise they would pass into the blood high up in the intestine, and have no local action on the lower parts of the bowel.

Sulphur is one of those drugs the *rationale* of whose purgative action is not as yet clearly understood. It is used officinally in the form of *Sulphur Sublimatum*, Flowers of Sulphur, and *Sulphur Precipitatum*, Precipitated Sulphur. The latter is prepared by decomposing an alkaline sulphide by an acid. Its texture is much finer, and its purity and activity greater than that of sublimed sulphur.

Sulphur appears to undergo no chemical alteration in the stomach; in the intestine it probably forms an alkaline sulphide. Large doses of it excite a moderate amount of colic and diarrhœa. Owing to the decomposition of the sulphide thus formed by the carbonic acid, or the free acids present in the lowest parts of the intestine, the greater part of the element can be detected unaltered in the fæces. Its prolonged use gives rise to chronic intestinal catarrh. The sulphide above-mentioned is to some extent absorbed by the blood, as we may conclude by the fact, that after sulphur has been long administered sulphuretted hydrogen is excreted by the skin and the kidneys, and larger quantities of sulphates are present in the urine.

When exposed to the air, and especially under the combined action of heat and protoplasmatic organisms (*e.g.* the *Oïdium Tuckeri* of the grape), sulphur unites with oxygen to form sulphurous acid, and hence acquires its well-known disinfectant properties.

Sulphur is used (1.) as a mild aperient, especially in cases of piles. (2.) It is frequently employed as an expectorant, and hence was designated by the old physicians *Balsamum Pectoris*. It is not impossible that small quantities of sulphuretted hydrogen are excreted by the bronchial mucous membrane, and that they thus exert a narcotic action upon the terminations of the irritated bronchial nerves. This is the more probable since if moderate quantities of this gas are introduced under an animal's skin they are also excreted by the air-passages (Demarquay). (3.) It has been highly praised by some authorities as a local application in the form of fine dusting powder, or as an inhalation, in certain infectious conditions, especially diphtheria of the pharynx. [(4.) Externally it is applied in the form of ointment in scabies, and in various forms of acne of the face.]

The *dose* both of sublimed and precipitated sulphur is 20—60 grs.

The following preparations are officinal:—

(1.) *Confectio Sulphuris*, B.P. (Sublimed sulphur, acid tartrate of potash, syrup of orange peel; 1 in 2¼.) *Dose*, ʒj.—ij.

(2.) *Unguentum Sulphuris.* (Sublimed sulphur, 1 pt., benzoated lard, 4 pts., B.P.; 1 pt.: 2 pts., U.S.)

The following drug may be regarded as a preparation of sulphur:—

Potassa Sulphurata, B.P., *Potassii Sulphuretum*, U.S. *Sulphurated Potash*, which mainly consists of K_2S_5. It forms an insoluble sulphide with salts of lead, and hence is used as an antidote in poisoning by the latter, in doses of 0·02—0·2 several times a day, in pills made with clay. In England, it is most frequently used to prepare a so-called sulphur bath, by the addition of about ℥ iv. to 30 gallons of water in a wooden tub. The addition of a little sulphuric acid (about ℥ ss. of crude acid) causes a more rapid evolution of sulphuretted hydrogen, a gas which is capable of absorption by the skin. [Such baths are extremely valuable in certain cases of general prurigo, especially infantile prurigo (*Lichen urticatus*), also in scabies and other parasitic diseases of the skin] and in poisoning by lead; in the latter case it is said that the skin ought to be blackened by their use. The following preparation is officinal:—

Unguentum Potassæ Sulphuratæ, B.P. (Gr. xxx., to ℥j. lard.) Employed in scabies.

[Sulphuretted hydrogen, a product of the decomposition of metallic sulphides, is believed to be an important ingredient of certain natural mineral waters, for example, Harrogate, in this country; Baden, in Austria; Aix-la-Chapelle and Aix-les-Bains, as well as Eaux Bonnes, Eaux Chaudes, Barèges, and other Pyrenean springs, in France.]

Oleum Ricini.

Castor Oil. Expressed from the seeds of Ricinus Communis, one of the East Indian Euphorbiaceæ. The main bulk of the oil consists of a compound of Ricinoleic acid with glycerin, which is soluble in alcohol, and as such has no active properties. The seeds also contain Ricinin, an alkaloid about which little is as yet known, but which appears to possess no poisonous or irritating properties. Owing to the action of the intestinal secretions upon the ricinoleic acid, an acrid substance is developed, which irritates the bowel, but whose activity is to a certain extent neutralised by that part of the oil which remains undecomposed. For this reason, castor oil may often be administered without injury, even in cases of constipation, accompanied by inflammatory irritation. The ordinary dose is a dessertspoonful, and owing to its repulsive viscid qualities, it is best to give it in half a tumbler of beer, or in a small teacupful of black coffee, [or well salted beef tea,] with which it is easily swallowed. [Castor oil, in doses of ♏v. in ʒj. water, with a little mucilage of acacia and syrup, is an excellent remedy in infantile diarrhœa, dependent on the presence of irritating food in the bowel.]

Fresh castor oil beans contain, in addition to oil and Ricinin, a substance which acts as an irritating narcotic. Many cases have been observed in which persons who have eaten six or eight beans have suffered not only from severe intestinal catarrh, but also from persistent headache, salivation, giddiness, palpitation, mydriasis, and spasms of the muscles of the back and limbs. As yet, however, the body which causes these symptoms has not been recognised with certainty. Ritthausen found that if the seeds were treated with emulsin, they developed hydrocyanic acid, and hence he suspects that they most likely contain some amorphous Amygdalin.

Rhamni Succus, *Buckthorn Juice.* Expressed from the berries of Rhamnus Cathartica (Rhamnaceæ), a wild native shrub. Its active constituent appears to be the amorphous Rhamnocathartin, which has an acrid bitter taste, a neutral reaction, and is soluble in water. It is only used as *Syrupus Rhamni*, B.P. (Buckthorn juice, ginger, pimento, sugar, spirit.) *Dose*, ʒ j.—ij. Its action is rather a powerful one.

Folia Sennæ.

Sennæ. The leaves of various species of Cassia (Cæsalpiniaceæ). Those officinal in England are Cassia Lanceolata, Cassia Obovata (Alexandrian senna), and Cassia Elongata (Tinnivelly senna). Their active constituent is Cathartic acid, which occurs in combination with lime and magnesia, and is soluble in water (Buchheim). The use of senna in sufficient quantities imparts a brown tint to the urine (cf. also Rhubarb).

As a household remedy, it is often given to children as a simple infusion in hot water. Medically, it is generally prescribed in one of the following forms:—

(1.) *Confectio Sennæ*, B.P. (Senna, coriander, figs, tamarinds, cassia pulp, prunes, extract of liquorice, refined sugar, distilled water; U.S. contains more cassia and no liquorice.) *Dose*, ʒ j.—ij.

(2.) *Infusum Sennæ.* (Senna, ginger, boiling water; 1 in 10, B.P.; with coriander, 1 in 16, U.S.) *Dose*, ℥ j.—ij.

(3.) *Mistura Sennæ Composita*, B.P. (Infusion of senna, sulphate of magnesia, extract of liquorice, tincture of senna, compound tincture of cardamoms; 1 in 5.) *Dose*, ℥j.—iss.

(4.) *Syrupus Sennæ*, B.P. (Senna, oil of coriander, refined sugar, distilled water, rectified spirit; 1 in 2.) *Dose*, ʒj.—ij.; for an infant, ♏xx.—ʒss. The Syrupus Sennæ, Pharm. Germ., contains manna.

(5.) *Tinctura Sennæ*, B.P. (Senna, raisins, caraway, coriander, proof spirit; 1 in 8.) *Dose*, ʒij.—viij.

(6.) *Extractum Sennæ Fluidum*, U.S. (1 in 1.) *Dose*, ℥ss.

(7.) *Extractum Spigeliæ et Sennæ Fluidum*, U.S. (*Vide* Spigelia, p. 275.)

The *Pulvis Glycyrrhizæ*, B.P., is practically a preparation of senna, and is copied from the *Pulvis Liquiritiæ Compositus* of the German Pharmacopœia, with the omission of two of its ingredients, powdered fennel and sulphur, to the latter of which part of the efficacy of the original preparation is probably due. The *Pulv. Liq. Co.*, Pharm. Germ., consists of 2 pts. each of powdered senna and powdered liquorice, 1 pt. each of powdered fennel and sulphur, and 6 pts. of white sugar. Two or three teaspoonfuls taken in the course of twelve hours are generally sufficient to produce a gentle aperient action.

Rhei Radix.

Rhubarb Root. The root of several undetermined species of Rheum, a plant growing in Chinese Tartary, but also cultivated in France, Austria, and England. Its chief constituent is a body which corresponds to Cathartic acid. The intense colouring matter which it contains, namely, Chrysophanic acid ($C_{15}H_{10}O_4$), will be considered separately later on. It also contains tannic acid, and some bitter principles. Rhubarb is a good stomachic when given in small doses of gr. iss.—iij. several times a-day, and it has a tendency, thus given, to diminish the number of motions, probably because its tannic acid and bitter principles then acquire a predominating action. In doses of from gr. viij.—xx. and upwards it produces frequent pulpy stools, with or without colicky pains according to the susceptibility of the patient and the strength of the dose. The colouring matter of rhubarb often turns the urine brown or red, just as if it contained bile pigment or blood; but its colour can be at once distinguished from that of the latter by adding a few drops of some mineral acid which renders it brighter, while it does not affect the latter. Rhubarb root contains oxalate of lime, and it is said that its long-continued use may give rise to the formation of vesical calculi composed of this salt.

The powdered root may be given alone or in pills. The following preparations of it are officinal:—

(1.) *Extractum Rhei.* (Rhubarb, rectified spirit, distilled water, B.P.; with alcohol only, U.S.) *Dose*, gr. iij.—vj., B.P.; gr. x.—xv., U.S.

(2.) *Infusum Rhei.* (An aqueous infusion; 1 in 40, B.P.; 1 in 33, U.S.) *Dose*, ℥ ss.—ij.

(3.) *Pilula Rhei Composita.* (Rhubarb, Socotrine aloes, myrrh, hard soap, oil of peppermint, treacle, B.P.; without soap or treacle, U.S.) *Dose*, gr. v.—x.

(4.) *Pulvis Rhei Compositus*, B.P., U.S., Gregory's powder. (Rhubarb, 2 pts., light magnesia, 6 pts., ginger, 1 pt.) *Dose*, for an adult, ʒ ss.—j., or about 1 teaspoonful by measure; for children, gr. v.—x., or more.

(5.) *Syrupus Rhei*, B.P. (Rhubarb, coriander, sugar, rectified spirit, distilled water.) *Dose*, ʒ j.—iv.

(6.) *Tinctura Rhei.* (Rhubarb, cardamom seeds, coriander, saffron, proof spirit, B.P.; without coriander and saffron, and with diluted alcohol, U.S.; 1 in 10.) *Dose*, ʒ j.—ij., as a stomachic; ℥ ss.—j., as a purgative.

(7.) *Vinum Rhei.* (Rhubarb, canella bark, sherry, B.P.; with diluted alcohol also, U.S.; 1 in 14.) *Dose*, ʒ j.—ij.

(8.) *Syrupus Rhei*, U.S. (Fluid extract of rhubarb, 3 pts., syrup, 29 pts.) *Dose*, ʒ ss.—ij.

(9.) *Syrupus Rhei Aromaticus*, U.S. (Rhubarb, cloves, cinnamon, nutmeg, syrup, diluted alcohol.) *Dose*, ʒ ss.—ij.

(10.) *Extractum Rhei Fluidum*, U.S. (Rhubarb, glycerin, alcohol, water; 1 in 1.) *Dose*, ʒ ss—ij.

(11.) *Pilulæ Rhei*, U.S. (Rhubarb, gr. lxxij., soap, gr. xxiv.; divided into 4-grain pills.) *Dose*, 1—2 pills.

(12.) *Tinctura Rhei et Sennæ*, U.S. (Rhubarb, senna, coriander, fennel, liquorice, raisins, diluted alcohol.) *Dose*, ℥ ss.—ij.

Tubera Jalapæ.

Jalap. The dried root of Exogonium Purga, one of the Convolvulaceæ of the Mexican Andes. Its active constituent is Convolvulin, a glucoside, with a weak acid reaction. It has a local action on the bowel, after undergoing solution by the bile. [Its chief effect is exerted on the intestinal glands, but it also stimulates the liver, rendering the bile more watery, while at the same time it increases the secretion of biliary matter (Rutherford and Vignal).] Jalap is given to adults in doses of gr. v.—x., if a mild purgative action is desired, but in doses of gr. xx.—xxx., if it is intended to produce a drastic effect.

A combination of 1·3 calomel and 1·0 gramme jalap is a favourite "derivative" remedy in inflammatory affections not associated with disease of the bowel, but it is very often vomited by the patient. The following preparations are officinal:—

(1.) *Extractum Jalapæ*, B.P., U.S. (Jalap, rectified spirit, distilled water.) *Dose*, gr. v.—xv.

(2.) *Pulvis Jalapæ Compositus*. (Jalap, acid tartrate of potash, ginger; 1 in 3, B.P., U.S., but the latter contains no ginger.) *Dose*, gr. xx.—lx., much used as a hydragogue purgative in renal dropsy.

(3.) *Jalapæ Resina*, B.P., U.S. (Extracted from jalap by means of rectified spirit.) *Dose*, gr. ij.—v. When decolorised by animal charcoal, it passes under the name of Jalapin.

(4.) *Tinctura Jalapæ.* (Jalap, proof spirit; 1 in 8, B.P.; 1 in 5, U.S.) *Dose*, ʒ ss.—ij. Jalap is also contained in *Pulvis Scammonii Compositus*, B.P.

Scammonium, *Scammony.* A gum resin obtained by incising the root of Convolvulus Scammonia, from Asia Minor. Its action it due to a substance which is very closely chemically allied to the convolvulin contained in the preceding drug, and which behaves in a similar way in the bowel. *Dose* of pure scammony, or of the *Scammoniæ Resina*, B.P., U.S., gr. iij.—x.

Preparations:—

(1.) *Confectio Scammonii*, B.P. (Scammony, ginger, oil of caraway, oil of cloves, syrup, clarified honey; 1 in 3.) *Dose*, gr. x.—xxx.

(2.) *Mistura Scammonii*, B.P. (Scammony resin, gr. iv., fresh milk, ℥ ij., made into an emulsion.) *Dose*, the above quantity for an adult; proportionately less for a child.

(3.) *Pilula Scammoniæ Composita*, B.P. (Scammony resin, resin of jalap, curd soap, strong tincture of ginger, rectified spirit.) *Dose*, gr. v.—xv.

(4.) *Pulvis Scammonii Compositus*, B.P. (Scammony, jalap, ginger; 1 in 2.) *Dose*, gr. x.—xx.

Aloe Barbadensis.

Barbadoes Aloes. Obtained from Aloe Vulgaris.

Aloe Socotrina.

Socotrine Aloes. Obtained from some undetermined species of aloes grown in Socotra.

The drug known as aloes is the dried resinous juice, which occurs in special groups of cells lying between the external green cell-layer of the fleshy leaves and the colourless middle layer, and it exudes from them when incisions are made into the leaves. The aloe plant (Liliaceæ) grows wild in warm climates. The best aloes comes from the Cape, and is hence alone prescribed by the German Pharmacopœia; it is also officinal, U.S. Pharm. The chief constituent is the active principle Aloëtin, an amorphous body without marked chemical properties. Opinions are not agreed as to the action of the crystalline Aloïn, another of its constituents. Aloes is said to be a bitter which promotes digestion. Its action on the bowel is believed to be mainly directed to the lower portion of the latter, in which it is supposed to excite a state of hyperæmia. Hence it has been credited with the power of improving sluggish piles by promoting hæmorrhage from them, as well as of inducing the menstrual flow in cases of amenorrhœa. One thing is certain, that aloes can be detected still unabsorbed quite low down in the intestine. It aggravates inflammatory conditions of the rectum. The *dose* of Barbadoes aloes is, gr. ij.—iv., and of Socotrine aloes, which is less active, gr. iij.—vi.

Preparations of Barbadoes aloes:—

(1.) *Enema Alöes Barbadensis*, B.P. (Barbadoes aloes, gr. xl., carbonate of potash, gr. xv., mucilage of starch, ℥ x.; for one enema.)

(2.) *Extractum Alöes Barbadensis*, B.P. (An aqueous extract.) *Dose*, gr. iss.—vj.

(3.) *Pilula Alöes Barbadensis*, B.P. (Barbadoes aloes, hard soap, oil of caraway, confection of roses; 1 in 2.) *Dose*, gr. iv.—viij.

(4.) *Pilula Alöes et Ferri*, B.P. (Barbadoes aloes, sulphate of iron, compound cinnamon powder, confection of roses; 1 in 5.) *Dose*, gr. v.—x.

Preparations of Socotrine Aloes:—

(1.) *Decoctum Alöes Compositum*, B.P. (Extract of Socotrine aloes, myrrh, saffron, carbonate of potash, extract of liquorice, compound tincture of cardamoms, distilled water. Contains gr. iv. aloes, in ℥j.) *Dose*, for an adult, ℥ss.—ij.; for a child of one year, ʒ ss. [Very useful in combination with equal parts of *Vinum Ferri*, when the latter constipates.]

(2.) *Enema Alöes Socotrinæ*, B.P. (Socotrine aloes, gr. xl., carbonate of potash, gr. xv., mucilage of starch, ℥x.; for one enema.)

(3.) *Extractum Alöes Socotrinæ*, B.P. (An aqueous extract.) *Dose*, gr. iss.—vj.

(4.) *Pil. Alöes Socotrinæ*, B.P., U.S. (Aloes, hard soap, oil of nutmeg, confection of roses; 1 in 2.) *Dose*, gr. v.—x., B.P.; gr. iv.—xx., U.S.

(5.) *Pil. Alöes et Assafœtidæ.* (Aloes, assafœtida, hard soap, confection of roses, of each equal parts, B.P.; omitting the confection of roses, U.S.) *Dose*, gr. v.—x., B.P.; gr. viij.—xx., U.S.

(6.) *Pil. Alöes et Myrrhæ.* (Aloes, myrrh, saffron, confection of roses; 1 in 3, B.P.; U.S., instead of saffron, contains syrup and aromatic powder.) *Dose*, gr. v.—x., B. P.; gr. viij.—xx., U.S.

(7.) *Tinctura Alöes.* (Aloes, extract of liquorice, proof spirit; 1 in 40, B.P.; 1 in 30, U.S.) *Dose*, ʒ ss.—ij.

(8.) *Vinum Alöes.* (Aloes, ginger, cardamom seeds, sherry; 1 in 26¾, B.P.; 1 in 16, U.S.) *Dose*, ʒ ss.—ij.

(9.) *Pilulæ Alöes et Masticheś*, U.S. (Aloes, ℥iss., mastic, red rose, āā ℥ss., make 400 pills.) *Dose*, one after each meal as a laxative.

(10.) *Tinctura Alöes et Myrrhæ*, U.S. (Socotrine aloes, myrrh, alcohol; one of each in 10.) *Dose*, ʒ ss.—ij.

Colocynthidis Pulpa.

Colocynth. The decorticated fruit of the form and size of an apple, obtained from Citrullus (Cucumis) Colocynthis, a species of cucumber cultivated in Southern Europe and in

Asia. It is said to have the property of readily causing increased peristaltic action of the bowel, without exciting gastric disturbance, or exhibiting any other specially injurious effects. Colocynth is prescribed by preference, and with transient good results, in all cases of dropsy in which it is impossible to remove the effusion by acting on the kidneys or the heart, or by any kind of general treatment. Its effects on the bowel are, however, said to be accompanied by hyperæmia of the kidneys. Its active constituent is probably a glucoside, soluble in water. [Colocynth is an hepatic stimulant of considerable power, increasing both the solid and liquid constituents of the bile. It also has a marked action on the intestinal glands (Rutherford and Vignal).] It should be remembered that colocynth often appears to be inactive, and especially when it has been long kept, hence it may be sometimes necessary to make inquiries of the druggist as to this point. Colocynth has an immediate action on the bowel, even when injected into the blood of an animal (Radziejewski). *Dose*, of colocynth, gr. ij.—viij.

Preparations:—

(1.) *Extractum Colocynthidis Compositum.* (Colocynth, extract of socotrine aloes, scammony, hard soap, cardamoms, proof spirit; 6 grains of the compound extract contain $\frac{1}{12}$ of their weight of the simple extract, half their weight of aloes, and $\frac{1}{6}$ of scammony. The U.S contains about $\frac{1}{7}$ of its weight of extract of colocynth.) *Dose*, gr. ij.—v., B.P.; gr. v.—x., U.S.

(2.) *Extractum Colocynthidis*, Extract of Colocynth, U.S. (An alcoholic extract, 7 ounces being obtained from 48 ounces of colocynth.) *Dose*, gr. ij.—v.

(3.) *Pilula Colocynthidis Composita*, B.P. (Colocynth, Barbadoes aloes, scammony, sulphate of potash, oil of cloves, distilled water; 1 in 6.) *Dose*, gr. v.—x.

(4.) *Pilula Colocynthidis et Hyoscyami*, B.P. (Pil. colocynthidis co., 6 pts., extract of hyoscyamus, 3 pts.) *Dose*, gr. v.—x.

(5.) *Pilulæ Catharticæ Compositæ*, U.S. (Compound extract of colocynth, gr. xxxij., extract of jalap, calomel, each, gr. xxiv., gamboge, gr. vj.; made into 24 pills.) *Dose*, 1—3 pills.

[**Elaterium**, B.P., U.S.

The sediment deposited by the expressed juice of Ecbalium Officinarum (Momordica Elaterium) Squirting Cucumber (Cucurbitaceæ), growing in Europe. It should contain from 20 to 30 per cent. of a crystalline glucoside, Elaterin, which is its active principle, and which is precipitated from a solution of the sediment, or extract, in boiling alcohol by potash. The elaterium of commerce is often adulterated.

Use.—As a powerful hydragogue cathartic, chiefly given in dropsy, especially when due to cardiac disease. It should be prescribed with care.

Dose of Elaterium, gr. $\frac{1}{16}$—$\frac{1}{4}$; of Elaterin, gr. $\frac{1}{40}$—$\frac{1}{6}$; but the latter is better avoided.

Preparation:—

Pulvis Elaterii Compositus, B.P. (Elaterium, sugar of milk; 1 in 10.) *Dose*, gr. ss.—v.]

Cambogia, B.P., **Gambogia**, U.S.

Gamboge. The yellow gum resin from Garsinia Morella of Siam (Guttiferæ). One of its active constituents is the resin, Cambogic acid, which forms about 70 per cent. of the drug. It does not appear, *per se*, to have any irritating qualities, and does not acquire such until it enters the bowel. According to Buchheim the presence of fat, and still more of bile, is necessary for their development. The products of the decomposition of gamboge have not been at present isolated, and we only know that they excite severe irritation of the bowel. Digestion does not appear to be impaired by gamboge in ordinary doses, and in this as well as its other property it agrees with colocynth. *Dose*, gr. j.—v.

Preparation :—

Pilula Cambogiæ Composita, U.S. (Gamboge, Barbadoes aloes, compound cinnamon powder, hard soap, syrup; about 1 in 6.) *Dose*, gr. v.—x.

Oleum Crotonis, B.P., **Oleum Tiglii,** U.S.

Croton Oil. Expressed from the seeds of Croton Tiglium (Euphorbiaceæ), a native of the East Indies. It is a fatty oil which contains Crotonic acid, and several volatile and non-volatile fatty acids (Buchheim). The acid is its active principle, and excites severe irritation when applied to the skin and the mucous membranes. It has not, however, been proved that the simple inunction of the oil into the abdominal wall can excite diarrhœa. Internally, a quarter of a minim will in the human subject cause watery diarrhœa. It is best administered in pills, or diluted with a fatty oil. The dose is from ♏ ⅛—j. (!). Owing to its powerful action it should be prescribed with great caution. [Externally, it is applied in a diluted form as a "derivative" liniment, and is used, but with very doubtful efficacy, in pulmonary affections. It generally produces a copious eruption of pustules, and a good deal of unpleasant irritation, and hence is unsuited to delicate skins.]

Preparation, B.P. :—

Linimentum Crotonis. (Croton oil, 1 pt., oil of cajeput, rectified spirit, of each 3½ pts.)

The composition of crotonic acid is as yet undetermined, but it appears to resemble that of ricinic acid.

[**Goa Powder,** *Chrysarobin*, also known as *Araroba* (not officinal), is imported from Bahia in South America. Its exact botanical source is unknown, but it is supposed to be derived from a tree belonging to the order Leguminosæ. It occurs in commerce in small amorphous friable lumps mixed with powder, and its colour varies from a pale grey to an amber brown.

It contains from 80—84 per cent. of chrysophanic acid ($C_{10}H_8O_3$) and 2 per cent. of resin (Attfield).

Action.—Given internally Goa powder is an emetic and purgative, unattended with much depression or griping pain. Small doses are more likely to purge than to cause vomiting, while with large doses vomiting is usually the first symptom. These effects appear to be due to the combined action of the chrysophanic acid and the resin, the latter being relatively far the more powerful. *Dose* of the powder, for adults, about gr. xxv.; for children, gr. vj. and upwards. It would seem, however, best to use the pure

Chrysophanic Acid (Not Officinal)

Extracted from it. The latter is a granular powder of a fine bright orange colour without smell or taste. It is crystallisable and freely soluble in benzole and in some alkaline liquids. It is also contained in rhubarb, senna (*vide supra*), and the common dock (Rumex).

Chrysophanic acid agrees with Goa powder in producing vomiting and purging. If, however, the dose given be too small it may only act as an emetic, but this is rare. When it purges, large quantities of bile are said to appear in the motions. The acid is best given on an empty stomach.

Dose, for a baby or child under ten years, gr. vj., as powder with honey or jam; for adults, of the powder, gr. x.—xv., but if given in a pill, gr. vj.—viij. suffice. *Dose*, of the resin, gr. j.—iv. (!) (Ashburton Thompson).

Externally, in the form of ointment, chrysophanic acid and Goa powder are irritants, and the acid especially is liable to cause inflammatory swelling of the parts, an erythematous scarlatinoid rash accompanied with itching, and followed by desquamation, and if applied to the neighbourhood of the eye, conjunctivitis. Both it and Goa powder stain the skin of a sunburnt brown tint, and the hair and the nails of a dark claret or purple colour, and the latter stains are difficult to remove. The linen also is stained by them. The urine sometimes resembles weak senna tea in persons using them.

Use.—Goa powder has long been used by the natives of India, China, and Brazil, in parasitic skin diseases, especially Burmese ringworm. It is made into a paste with a little vinegar or water and rubbed into the affected parts. It has been used in England with success in the treatment of pityriasis versicolor. In *non*-parasitic skin diseases (psoriasis, acne rosacea, and chronic eczema in circumscribed patches), chrysophanic acid is stated to be superior to Goa powder, though it is no more a specific than any older drug. It should be applied as an ointment of gr. xx.— ʒ ij. : ℥ j. melted lard (B. Squire).]

[Podophylli Radix.

The rhizome of Podophyllum Peltatum, May apple, is officinal, B.P., U.S. It produces abundant loose evacuations, and somewhat resembles jalap in its action.

Preparations :—

(1.) *Resina Podophylli*, B.P., U.S. *Dose*, gr. ¼—j.

(2.) *Extractum Podophylli*, U.S. (An alcoholic extract.) *Dose*, gr. v.—x.]

We must here make a few additional remarks upon the action of Physostigmin on the intestine, to which theoretical allusion has been already made at page 21. In some cases of atony of this organ, and especially where there was a considerable fæcal accumulation in the ascending colon, extract of calabar bean, Pharm. Germ., rendered good service after drastic purgatives had completely failed (V. Subbotin). The dose was $\frac{1}{8}$ grain four times a day, continued for a fortnight. It was also efficacious in a case of chronic bronchitis in which the expectoration was difficult, owing probably to an atonic condition of the bronchial muscles. In any case the extract deserves increased attention as a remedy in habitual constipation. Much of its success will depend on the use of a good preparation, and a freshly prepared æthereal extract would probably be the most efficient.

ANTHELMINTICA.

WORM MEDICINES,

Are used to remove parasites from the intestine. They are generally given in combination with purgatives, since the parasites are often only stupefied by the vermifuge, and not really dislodged. The most efficient drugs of this class are the following :—

Santonica (Flores Cinæ), B.P., U.S.

The unexpanded flower buds of an undetermined species of Artemisia, introduced into commerce from Western Asia. They are used for preparing the officinal *Santoninum* or *Santonin* ($C_{15}H_{18}O_3$), a crystalline body with properties resembling those of an acid. It is scarcely at all soluble in water, but dissolves in alcohol or fatty oils. Santonica also contain an æthereal oil.

The *action* of santonin, as far as it is of importance for therapeutic purposes, may be explained as follows :—The greater part of the drug can be detected unaltered in the motions, and in its passage through the bowel it either kills or temporarily paralyses the *ascaris lumbricoides*, just as it has been found that it, of all the ordinary anthelmintic drugs, most rapidly destroys this parasite when brought into contact with it outside the bowel. If larger doses are given, it is probable that part of the santonin is absorbed in the form of santonate of soda, and that to this is due the well-known symptom of yellow vision (which may be regarded as a direct disturbance of the organs of perception), as well as the general depression and state of mental stupidity which it occasionally produces. In some children, especially those in an anæmic condition, Santonin has been known to cause convulsions and death. The convulsions are due to irritation of the central portions of the brain, especially those from which the cerebral nerves from the third to the seventh, take origin.

The æthereal oil is said to have no anthelmintic properties; in other respects it resembles the other members of its class.

Santonin is the chief remedy for the *ascaris lumbricoides.* Its *dose,* is gr. ij.—vj. once a day, or gr. $\frac{1}{3}$—ij. several times a day, in a little honey or preserve, or in the form of lozenges.

In warm-blooded animals the convulsions produced by Santonin can be checked by the inhalation of æther, or by a few doses of chloral hydrate.

The crystals of santonin are at first quite colourless, but gradually turn yellow in the light.

The solubility of santonin in fatty oils makes it advisable not to give it in combination with castor oil, as its absorption may possibly be promoted by so doing. A mild purgative should, however, always be administered a few hours after it.

Preparations :—

(1.) *Trochisci Santonini,* U.S., Santonin lozenges, each containing gr. ss. of santonin. *Dose,* 1—4.

The German Pharmacopœia also has

(2.) *Natron Santonicum* ($NaC_{15}H_{19}O_4$), Santonate of Soda. Santonin in the presence of alkalies readily combines with water to form santonic acid. The soda salt is readily soluble. *Dose,* 0·05—0·1.

Filix Mas.

Male Fern. The dried root of Polystichum Filix, or Aspidium Filix Mas, a common fern of Northern Europe. Its active constituents are the crystalline Filicic acid, as well as another compound which has not as yet been isolated (Rolle). All that is really efficient is probably contained in the officinal *Extractum Filicis Liquidum*, B.P., an ethereal extract of the fresh root. It should always be used if the plant itself cannot be obtained quite fresh, since the latter, if kept, soon loses its effect, probably owing to decomposition of its essential ingredients. The *dose* of the root itself is ʒj.—iij., either as such, or in the form of an unstrained decoction of the extract, ʒss.—j., or more, in emulsion with mucilage of tragacanth, in either case preceded and followed by an aperient. It is mainly used in the treatment of tapeworm. U.S. has an *oleo-resin* of fern answering to the æthereal extract, B.P. *Dose*, ʒss.

Granati Radicis Cortex.

Pomegranate Root Bark. Obtained from Punica Granatum (Myrtaceæ), a native of warm countries, cultivated in some parts of Europe as an ornamental tree. Its active constituent is as yet unknown. It contains a quantity of tannin, and is used with success, if tolerably fresh, in the treatment of tapeworm. A good method of using it is to macerate from 30·0—50·0 grammes of the powdered root for 12 hours with 200·0—250·0 water, and then to evaporate down to 150·0—250·0. After the patient has been prepared in the ordinary way by fasting and a purgative, he is to drink the decoction the next morning in three portions, and then to take a second purgative. To make assurance doubly sure, it has been recommended to add half a drachm of the *Extractum Filicis liq.* to the decoction just before using it.

Maceration of the root is often alone sufficient, and is said to be much less irritating to the digestive tract than the decoction, which can still, if necessary, be used later on (Niemeyer).

Preparation:—

Decoctum Granati, B.P. (Pomegranate root bark, 1 pt., distilled water, 20 pts., evaporated to 10 pts.) *Dose*, ℥j.—ij.

Cusso, B.P., Koosso, U.S.

Kousso. The flowers of Brayera Anthelmintica, obtained from an Abyssinian tree belonging to the order Rosaceæ. They have a slight aromatic smell, and somewhat bitter taste. Their action on the tapeworm depends on an irritating bitter resin, Koussin, which has been recently much prescribed in the pure state, and, it is said, with good effect, in doses of 4—5 grains, repeated three times at short intervals. If the blossoms themselves can be procured genuine, and not too old, their action is as rapid and certain as that of fresh pomegranate bark and fresh male fern, but all three of these drugs are liable to fail, either when given alone or in combination with others, if long kept. Large doses of Kousso produce nausea and vomiting in certain individuals quite as readily as the two other vermifuges.

The value of *isolated* Koussin is somewhat doubtful, owing to the greater ease with which it is absorbed.

Preparation:—

Infusum Cusso, B.P. (Kousso powder, ℥¼, boiling distilled water, ℥iv.; to be infused for fifteen minutes and drunk, unstrained, in one dose.)

Areca, B.P., Betel nut, the seed of Areca Catechu from the East Indies, is sometimes given as a remedy for tapeworms in doses of ʒiv.—ʒvj. It is, however, chiefly employed in the form of paste for cleaning the teeth.

Kamala.

Kamala. The glands of the capsules of Rottlera Tinctoria, one of the East Indian Euphorbiaceæ. It is a brick-red powder. Its active constituent is said to be a balsamic resin, and it also contains a crystalline body, Rottlerin. Kamala is reported by many good authorities to be an efficient remedy for tapeworm, and to have the additional advantage over kousso of less readily causing sickness. It is also said to have a purgative action. The *dose* is ʒj.—ij. suspended in mucilage, or given as a powder in wafers. Each *dose* should be divided into two halves, to be administered at intervals of half an hour.

[The U.S. Pharm. also has

Spigelia, the root of Spigelia Marilandica, Indian Pink Root. Used in the treatment of *ascaris lumbricoides.*

Dose of the powdered root gr. x.— ʒ ss. every night and morning until the worms are expelled, but generally given as one of the following

Preparations:—

(1.) *Extractum Spigeliæ Fluidum.* (1 in 1.) *Dose,* ʒj.— ℥ ss.

(2.) *Infusum Spigeliæ.* (1 in 16.) *Dose,* ℥ ss.—ij.

(3.) *Extractum Spigeliæ et Sennæ Fluidum.* (Fluid extract of spigelia, ℥ x. fluid extract of senna, ℥ vj., oil of anise, oil of caraway, each ♏xx.) *Dose,* ʒ ij.— ℥ j.]

DIURETICA.

Diuretics.

If we understand by this title only such drugs as increase the quantity of urine excreted in a given period, by the direct stimulant effect which they exert upon the secreting tissues of the kidneys, other conditions remaining unaltered, there are very few drugs which answer to this description. In most cases the increase of the urinary secretion, and the absorption of dropsical effusions from the tissues, are brought about in a very different manner.

In the first place it is by improving the digestive and assimilative functions that we increase the quantity of urine excreted; for by raising the nutritive tone of the system generally we induce more powerful contractions of the heart, and so raise the pressure in the branches of the aorta, and hence in the vessels of the Malpighian capsules of the kidneys. Thus it happens, that good food, and the most various drugs, for example iron and bitter medicines, exert a "diuretic" action, and that from the very commencement of their use the quantity of urine increases, and dropsical effusions begin to abate. We must also take into account the smaller amount of watery transudation into the connective tissues which occurs when the blood has a normal composition, than when it contains a relative excess of water, for in the former case the excess finds its natural exit through the kidneys. It has not, however, been proved, that any of the above-mentioned drugs exercises a direct effect upon the kidneys which can be utilised for therapeutic purposes.

Digitalis and quinia must be classed with the other drugs above mentioned, since the *rationale* of their diuretic action is precisely similar in both cases. When given in *moderate* doses in cardiac asystolism they increase the arterial pressure, and hence the amount of water which passes off by the kidneys, without exerting any irritating effect upon the latter. We can, therefore, only expect that they will have a diuretic action in cases in which the arterial pressure is too low. Quinia is also a diuretic in the dropsy which not unfrequently accompanies enlargement of the spleen, and here it is certain that it produces its effect by improving the quality of the blood.

Clinical experience also appears to have proved, that many salts, which are absorbed into the blood and excreted through the kidneys, remove a larger quantity of water than usual from the body in their passage out. In dealing with potassium salts we should of course have to take their possible action on the heart into account.

In the case of the otherwise inactive sodium salts we possess, in the results of exact experiments on the influence of chloride of sodium upon the urine, some reliable *data* which coincide with clinical observations. After taking 5·0 grammes of chloride of sodium, the average secretion of water by the kidneys in a given period was equal to 923, and that of urea to 103 grammes; while, after taking 20·0 grammes of chloride of sodium, they rose to 1,204 and 113 grammes respectively. Owing to its physical properties chloride of sodium intensifies the onward flow of liquids (*Saftströmung*) in the tissues, and hence increases the oxidation of albumen. Now, to enable the salt to leave the body by the urine, water is necessary, and this water passes out with the urine, and is derived from that quantity which is usually excreted by the lungs, and if this be insufficient, from the liquid contained in the various other organs of the body (Voit).

We are ignorant as yet how other diuretics act. In any case their action is less marked than that of the above-named. Hypothetically we can easily imagine, that any drugs which act directly on the kidneys do so, either by relaxing the walls of the Malpighian corpuscles in their passage through them, or by stimulating the nerves which dilate their blood-vessels, so that they not only permit more urinary water to escape, but also diminish the resistance which it meets with in filtering through their walls. It is impossible, however, to overlook their good effect in suitable cases. We may take as a representative of this class the following drug, whose diuretic properties have been examined with some accuracy.

Sodæ Nitras ($NaNO_3$), B.P., U.S., *Nitrate of Soda. Chili*

Saltpetre, so called because it is found in large deposits on the borders of Chili and Peru. It was formerly regarded as a cooling salt whose general action resembled that of nitrate of potash, but was milder. Experiments on (healthy) warm-blooded animals proved, however, that even in poisonous doses it did not reduce the temperature in the least, and that the heart continued to beat with normal frequency and force almost up to the moment of death (Guttmann). Recently it has been shown that comparatively moderate doses have a diuretic action on dogs (Grützner), hence this action must be due to the direct effect of the nitrate of soda upon the renal tissues, and must be independent of changes in the renal nerves, or in the arterial pressure. *Dose*, gr. v.—xx.

[The following drug may be provisionally inserted here:—

Scoparii Cacumina, B.P., U.S., *Broom tops*. The fresh and dried tops of Sarothamnus Scoparius, *Common Broom* (Leguminosæ). In France the *flowers* are also in use. The tops contain a neutral, pale yellow, crystallisable body, Scoparin ($C_{21}H_{22}O_{10}$), supposed to be the diuretic principle, and Spartein ($C_{15}H_{26}N_2$), an oily base sparingly soluble in water, with narcotic properties, resembling those of narcotin (Stenhouse, Fick). It forms double chlorides with the chlorides of platinum and mercury. Four grains of spartein will kill a large rabbit. The green plant contains *inter alia* 27·6 per cent. potash, 24·1 lime, and 12·3 anhydrous phosphoric acid (Sprengel).

Use.—Empirically as a diuretic in cardiac dropsy, also in albuminuria (Bouchardat). The effect of broom tops is probably due to the Scoparin, and they appear to act by improving the tone of the vascular system, and increasing arterial tension.

Preparations:—

(1.) *Decoctum Scoparii*, B.P. (Broom tops, distilled water; 1 in 20.) *Dose*, ℥ ij.—iv.

(2.) *Succus Scoparii*, B.P. (Expressed juice of fresh broom tops, 3 pts., rectified spirit, 1 pt.) *Dose*, ʒ j.—ij.]

DIAPHORETICA.

DIAPHORETICS.

It has been usual to place *Diaphoretic* drugs, *i.e.* those which induce perspiration, in close proximity to diuretics. If the number of the latter, supposed to exert a specific action on the kidneys, has dwindled down to a very small fraction of those which were formerly held in repute, this is still more true of diaphoretics. It is probable that we do not possess many drugs which when introduced into the blood alone, and without the assistance of large quantities of warm fluid, can directly and powerfully increase the activity of the sweat glands. Everything which elevates the temperature of the body up to a certain limit, and which stimulates the heart's action, and causes dilatation of the vessels of the skin, can act as a diaphoretic. On the other hand, every drug which quickly reduces severe fever must be called a diaphoretic. In certain stages of fever the arteries of the skin are contracted, and hence less water than usual reaches the outer surface of the body (Traube). When the fever diminishes the reverse takes place, so that diaphoresis is thus not the cause, but the effect of the fall of temperature.

The pre-eminent dependence of the perspiratory secretion on the nervous system has lately been brought strongly into notice by the discovery of a Brazilian drug, named

Jaborandi (Not Officinal),

Which consists of the leaves of Pilocarpus Pinnatus, a shrub belonging to the order Rutaceæ. Its active constituent is an alkaloid Pilocarpin, which forms crystallisable salts with mineral acids, and which when subcutaneously injected excites the characteristic phenomena peculiar to the leaves

(Gerrard, Merck). Internally, as an infusion of 4·0—6·0 grammes (ʒj.—iss.), the leaves produce profuse perspiration and salivation. These symptoms are often accompanied with nausea and vomiting [and sometimes with collapse]. The action of jaborandi leaves upon the sub-maxillary glands occurs even after division of the *chorda tympani*, and the sympathetic nerves. Atropia arrests their effect, both on the salivary and the sweat glands.

[The direct application of a few drops of a 2 per cent. solution of pilocarpin to the conjunctiva causes strong contraction of the iris in five to ten minutes, which lasts many hours. (Weber, Curschmann). Large doses of pilocarpin reduce the pulse frequency to thirty or even to twelve or eight beats per minute, by stimulating the inhibitory fibres of the vagus in the heart itself (Leyden and Fränkel).]

The leaves have been clinically tested in a number of cases, in which absorption of various forms of serous effusion was desired, but as yet no definite conclusion as to their value is possible. If anything, we may say that the artificial induction of sweating as a therapeutic agent by their means has not completely answered the expectations which they at first excited. A. Weber has, however, recently obtained excellent results in a case of œdema of the lungs in croup. The symptoms of asphyxia subsided in three and a half hours after very profuse sweating and salivation. The *dose* of hydrochlorate of pilocarpin was 0·02, = gr. ⅓, injected subcutaneously. The child was three years old.

[Leyden and Curschmann both report good results with pilocarpin (hydrochlorate) in acute nephritis. 0·03 gramme is a large dose for an adult subcutaneously. In England, nitrate of pilocarpin has been used in gr. ¼ doses.

CHAPTER XI.

CAUTERIA.

CAUSTICS.

UNDER this heading we may group together those remedies, which, when applied to the skin, and to other tissues, not only produce the sensation of burning, but also cause congestion and exudation, separation of their epidermis, and, if still continued, their chemical destruction. When classified according to the varying intensity of their action, they are also called *Rubefacients*, *Vesicants*, and *Caustics*, in the narrower sense of the word.

The remedies included in this class can act in one of two ways:—(1.) By penetrating the epidermis and exciting a resolvent inflammation in the parts beneath. This action has already been mentioned in speaking of tincture of iodine. (2.) By exerting a powerful reflex stimulus on the central organs. Our present knowledge on this subject may be summed up as follows:—

A relatively slight amount of irritation of the skin strengthens the contraction of the heart, diminishes the calibre of the blood-vessels, and accelerates the circulation. Powerful cutaneous stimuli weaken the heart's contractions, dilate the blood-vessels, and retard the circulation. The locality of the stimulus is immaterial as far as the general effect is concerned.

The longer such a stimulus is applied, the longer its action afterwards continues. The irritating effect of a relatively weak stimulus also persists for a certain time after the stimulus has ceased, but is at last succeeded by a period of depression. The latter, however, supervenes later, and in a much less accentuated form than when it follows the use of a powerful stimulus.

Such a stimulus when applied to the skin, *i.e.* to the sensory nerves, is invariably followed (generally after a longer or shorter period of fever) by a fall in the temperature of the body. This depression, just as that which is produced by cold baths, is compensated for by an increased production of carbonic acid and an increased consumption of oxygen, these being dependent on reflection of the stimulus from the skin through the centripetal nerves to the heat-producing organs (O. Naumann and others.)

In spite of these theoretical considerations no one has as yet clearly proved that counter-irritation is of *real use* in diseased conditions, such as pulmonary inflammations, &c. No proof, however, is needed of the pain and discomfort which they inflict on the patient.

Most of the rubefacients and vesicants are of organic origin, while the caustics proper almost all belong to the inorganic world. The following members of the former class are still officinal:—

Semina Sinapis.

Mustard. Mustard seeds, obtained from Brassica Nigra (Cruciferæ), a native plant. Their rubefacient action is due to an æthereal oil, sulphocyanide of allyl (S,CN,C_3H_5), *Oleum*

Sinapis, B.P., which is formed when they are allowed to ferment at a moderate temperature in the presence of water. The ferment present is Myrosin, a body similar to emulsin. It almost instantaneously decomposes the myronate of potash contained in the black mustard seeds, into bisulphate of potash, sugar, and oil of mustard, the latter of which is readily recognised by its unpleasant pricking smell.

It is said that a severe rigor can be produced by immersing the whole body in a bath in which mustard seeds are infused at a temperature of 30° Centigrade, so as to redden the skin (Trousseau).

The seeds are used in the following way:—100—200 grammes in powder are mixed with a sufficient quantity of tepid water to make a stiff paste, which is spread upon linen to a depth of several lines, and applied directly to the unbroken skin without the intervention of any intermediate substance. It is allowed to remain there until the patient feels intense burning (20—30 minutes) which he is at length unable to endure any longer. The reddened skin is then wiped with a soft sponge or cloth, and protected with a fine handkerchief or a piece of flannel.

Hot water must not be used in mixing the mustard, otherwise the effect of the Myrosin, like that of all ferments, is destroyed; it must not be *cold*, otherwise the development of the oil is not certain to occur; and, lastly, the mustard must not be mixed with vinegar, as the latter checks the process of fermentation.

[Mustard is occasionally used as an emetic in cases of poisoning when other remedies are not at hand. The *dose* for this purpose is ʒ j.—iv.

The following preparations are officinal:—

(1.) *Cataplasma Sinapis*, B.P. (Powdered mustard, linseed meal, of each $2\frac{1}{2}$ pts., tepid (the British Pharmacopœia orders *boiling* (!) water, 10 pts.)

(2.) *Linimentum Sinapis Compositum*, B.P. (Oil of mustard, æthereal extract of mezereon, camphor, castor oil, rectified spirit; 1 in 40.)

(3.) *Oleum Sinapis*, B.P. (S,CN,C_3H_5). Contained in Linimentum Sinapis Co. It must only be applied to the skin largely diluted, *e.g.*, ♏x. to ℥j. rectified spirit.

(4.) *Charta Sinapis*, B.P. (Black mustard seeds, in powder, ℥j., solution of gutta percha in chloroform, ℥ij.) The mustard is mixed with the gutta percha solution, and strips of cartridge paper are thinly coated with it on one side and allowed to dry. *Charta Sinapis*, U.S., is made with black mustard powder, 90 grs., made into a paste with the solution of gutta percha, and spread on one side of a piece of paper four inches square. Either paper must be dipped in warm water for a few seconds before application to the skin.]

Mezerei Cortex, *Mezereon.* The dried bark of Daphne Mezereum (Thymelaceæ), a plant which is distributed over nearly the whole of Europe. It contains a very irritant resin, which excites blistering and serous exudation when applied to the unbroken skin.

[In the form of the following preparation it is contained in *Linimentum Sinapis Compositum*, B.P.

Extractum Mezerei Æthereum, B.P. (Mezereon bark, rectified spirit, æther; prepared by maceration and evaporation to a soft extract.) The *Extractum Mezerei Fluidum*, U.S. (Mezereon, alcohol; 1 in 1), is used for preparing *Unguentum Mezerei*, U.S. (Fluid extract of mezereon, f℥iv., lard, ℥xiv., yellow wax, ℥ij.

The bark itself is an ingredient in Decoctum Sarsæ Compositum, B.P. U.S., and it was formerly much used as a decoction or syrup in constitutional syphilis, and inveterate skin diseases (Biett, Cazenave).]

Cantharis.

Spanish Fly, *Cantharides.* A beetle, Cantharis Vesicatoria, of a greenish gold colour, 20—25 millimetres long, and 4—6 millimetres broad, with a strong unpleasant smell. It occurs in Spain and also in the North of Europe. Its blistering power is due to the presence of Cantharidin ($C_5H_6O_2$), a white crystalline body, which has the chemical properties of an acid, and which when administered internally produces severe inflammation of the stomach, intestines, and urinary organs. It is soluble *inter alia* in fatty oils. To this property its action, when in the form of a plaster, is due, for the cantharidin gradually dissolves in the fatty ingredients of the latter (which is not a plaster at all in the chemical sense of the word, but consists of a mixture of oil, wax, and turpentine), and so excites exudation of serum from the skin and the formation of blisters.

In the course of poisoning by cantharides, pharyngeal spasms may occur, and simulate hydrophobia by rendering drinking impossible. If cantharides be too long or too extensively applied, it may produce inflammation of the kidneys and bladder. Hence its use demands special care. It is given internally in the form of tincture, which should be always mixed with mucilage, so as to protect the mucous membrane of the stomach and intestine. Owing to the injurious effect on the kidneys which it so readily induces it should be ordered as seldom as possible. It has been recommended as a diuretic, and also as a stimulant in atony of the generative apparatus and of the bladder. [Besides being used externally for "derivative" purposes, cantharides, in a diluted form, is applied to the skin in *alopecia areata*, and other forms of alopecia, to promote the growth of the hair; also in *tinea tonsurans* in the form ot

Liquor Epispasticus to loosen those hairs which are attacked by the fungus.]

Preparations: —

(1.) *Acetum Cantharidis*, B.P. (Cantharides, glacial acetic acid, acetic acid; 1 in 10.) Only used externally.

(2.) *Charta Epispastica*, B.P.; *Charta Cantharidis*, U.S. Blistering paper. (White wax, spermaceti, olive oil, resin, Canada balsam, cantharides, distilled water; 1 in 15½, B.P.; only half the strength, U.S.)

(3.) *Emplastrum Cantharidis*, B.P. (Cantharides, yellow wax, suet, resin, prepared lard; 1 in 3.)

(4.) *Emplastrum Calefaciens*, B.P. (Cantharides, boiling water, oil of nutmeg, yellow wax, resin, soap plaster, resin plaster; 1 in 25.)

(5.) *Liquor Epispasticus*, B.P. Blistering fluid. (Cantharides, acetic acid, æther; 1 in 2½.)

(6.) *Tinctura Cantharidis*, B.P. (Cantharides, proof spirit; 1 in 80.) *Dose*, ♏v.—xx. U.S. much stronger. (1 in 30.) *Dose*, ♏xx.—lx.

(7.) *Unguentum Cantharidis.* (Cantharides, yellow wax, olive oil; 1 in 8, B.P,; 1 in 12, U. S.)

(8.) *Linimentum Cantharidis*, U.S. (Cantharides, ℥j., oil of turpentine Oss.; digested for three hours and strained.)

(9.) *Emplastrum Picis cum Cantharide*, U.S. (Burgundy pitch, cerate of cantharides; 1 in 12.)

(10.) *Ceratum Cantharidis*, U.S. (Cantharides, yellow wax, resin, lard; 1 in 3.)

(11.) *Ceratum Extracti Cantharidis.* (Made by extracting 5 troy ounces cantharides with 2½ pints stronger alcohol, evaporating, and melting with resin, ℥iij., yellow wax, ℥vj., lard, ℥vij.)

The German Pharmacopœia contains a convenient preparation of cantharides called *Collodium Cantharidatum.* It is made by dissolving *gun cotton in æther* which has been allowed to stand over cantharides. The collodion is painted over a portion of skin of the required size, and after the usual time (10—15 hours) the epidermis rises with the collodion in the form of a blister, and the collodion can then be easily removed. The *Collodium cum Cantharide*, U.S, closely resembles the above preparation.

We have already referred to the use of tartar emetic ointment (p. 238), and croton oil liniment (p. 268), for derivative purposes.

Here may also be mentioned the

Tinctura Thujæ, Pharm. Germ. prepared from the fresh leaves of Thuja Occidentalis (Coniferæ). It contains an acrid æthereal oil, and is used for painting cutaneous outgrowths, especially warts and flat condylomata.

Also **Elemi**, an oleo-resin obtained from Canarum Commune (Amyridaceæ) and other plants of the same order. It is a native of Yucatan, and is imported from Manilla. It is used as a mild local stimulant in the form of *Unguentum Elemi*, B.P. (Elemi, simple ointment; 1 in 5).

The old surgeons distinguished between the actual cautery and the potential cautery, meaning by the former the red hot iron and the moxa, and by the latter the whole group of chemical caustics.

The Pharmacopœia contains acids, bases, and salts, which are used as caustics. The acids are the following:—

(1.) *Acidum Aceticum*, Acetic Acid.

(2.) *Acidum Arseniosum*, Arsenious Acid, the chief constituent of the *Pulvis Arsenicalis Cosmi*, or arsenical paste of the brothers Cosme, in which it is mixed with cinnabar, animal charcoal, and dragon's blood. It has been much used to destroy cancer, especially on the face. It only acts on the part to which it is directly applied.

(3.) *Acidum Nitricum.* Either the ordinary crude acid, or the fuming acid which contains nitrous acid. It is used for destroying warts and nævi, and also chancres in the early stage, its action extending into the deeper layers of the integument. It has the disadvantage, however, of being liable to extend peripherally and destroy the healthy tissues around.

Chloracetic Acid, a substitution product of acetic acid, is free from this latter defect. According as one, two, or three atoms of its H are replaced by Cl, its caustic action varies; the compound which contains three atoms of chlorine, or *tri*-chloracetic acid, being the most active caustic. A convenient preparation is a mixture of *mono*- and *di*-chloracetic acids, which readily destroys ordinary epithelial growths on the skin, which, as is well known, resist the milder caustics. This caustic is not officinal, but it has been praised by various surgeons, among others by Von Bruns, of Tubingen.

The German and American Pharmacopœias also contain the following acids :—

Acidum Lacticum, *Lactic Acid* ($C_3H_6O_3$). A syrupy liquid obtained during the fermentation of several carbohydrates, and especially recommended as an inhalation to dissolve croupous or diphtheritic membranes. It is to be used in the form of spray (15—20 drops in ℥ iv. water).

Acidum Chromicum (CrO_3), *Chromic Acid.* Yellowish red deliquescent crystals readily soluble in water.

The following bases are used as caustics :—

Potassa Caustica (KHO).

Potassa Fusa, Caustic Potash. Melted and cast into the form of sticks. It is the most powerful and rapid caustic we possess (von Bruns). It penetrates tolerably deeply into the subjacent tissues, but unfortunately destroys a larger superficial area than that to which it is primarily applied. [Dissolved in an equal weight of water and carefully painted on with a tiny sponge, it is valuable as a caustic in lupus (E. Wilson). Largely diluted in the form of *Liquor Potassæ* it is sometimes given internally as an antacid, and also in rheumatism and other affections for which the carbonate is also used.]

Preparation :—

Liquor Potassæ, B.P. (Prepared by the action of slaked lime on a solution of carbonate of potash. It should have a sp. gr. of 1·058, B.P. ; 1·065, U.S.) *Dose*, ♏xv.—lx., B.P. ; ♏ij.—xx., U.S.

The carbonate of potash has a similar action to that of caustic potash, but is much less energetic. It has been much used and recommended of late (W. Busch) to gradually macerate hard epidermic outgrowths. A 30 per cent. solution of *caustic soda* has also a similar action to that of caustic potash, but in a milder form.

Calcis Hydras, *Calx* (CaH_2O_2), Slaked or Caustic Lime. When mixed with caustic potash in equal quantities it forms *Vienna paste*, a caustic which is not very painful, and which has a slow and limited action. It may be used for opening abscesses, buboes, &c., in persons who are afraid of the knife. The skin to be destroyed is surrounded with several layers of plaster, so as to protect the neighbouring parts from the caustic. It is then covered with the paste, and the whole is enclosed with another layer of plaster. If the abscess is not opened within twenty-four hours, the part must be washed thoroughly clean, and then re-covered with another layer of paste.

The following salts are officinal caustics :—

Argenti Nitras, B.P. **(Fusa,** U.S.**)**

Nitrate of Silver, melted, and cast into sticks. Valuable for superficial cauterisation, and for destroying the tubercles of lupus of the face, as it does not injure the healthy tissues. *Mitigated Nitrate of Silver.* A combination of 1 pt. of nitrate of silver with 2 pts. of nitrate of potash, melted together and moulded into sticks, is sometimes preferable to the pure nitrate, owing to its milder action.

Alumen Exsiccatum, B.P., U.S., *Burnt Alum.* Prepared by driving off the water of crystallisation from ordinary alum. It is used as a mild caustic to sprinkle on unhealthy or too freely granulating wounds.

Cupri Sulphas.

[*Sulphate of Copper* is applied in the solid form to the eyelids in granular conjunctiva, and also as an astringent lotion, gr. ij. ad ℥j. water in simple conjunctivitis. Fifteen grains dissolved in ʒj. water form an admirable solution for destroying soft chancres, or for cleansing unhealthy ulcers (Sigmund). It causes scarcely any pain, and does not injure the healthy tissues.]

The German Pharmacopœia contains a combination called *Cuprum Aluminatum,* consisting of equal parts of sulphate of copper, nitrate of potash and alum, fused with $\frac{1}{50}$ of their weight of camphor. It is specially used in ophthalmic medicine and is known as *Green stone,* or *Lapis Divinus.*

Liquor Ferri Perchloridi Fortior, B.P.

A solution of perchloride of iron of sp. gr. 1·44, used either pure or diluted with water as a styptic, or as an injection into nævi, &c. Its action is due to the evolution of chlorine. [A 30 per cent. solution has been found experimentally to have the most powerful styptic effect (Krobischer).]

Hydrargyri Perchloridum, *Corrosive Sublimate*, is used as a caustic in concentrated solutions, and also as a lotion containing gr. iij. in ʒ v. water, to remove the epidermis, and thus get rid of freckles and other forms of pigmentation of the Malpighian layer.

The following preparations of mercury, which are chiefly used for dressing syphilitic ulcers, are officinal.

(1.) *Lotio Hydrargyri Flava*, B.P. (Corrosive sublimate, gr. xviij., lime water, ℥ x.)

(2.) *Lotio Nigra*, B.P. (Calomel, gr. iij., lime water, ℥ j.) In the former of these, the mercury is present in the form of oxide, and in the latter of suboxide.

(3.) *Unguentum Hydrargyri Subchloridi*, B.P. (Calomel, 1 pt., prepared lard, 5½ pts.) This ointment is useful not only in cutaneous syphilis, but also in pruritus of the external genitals and perinæum.

Hydrargyrum Ammoniatum ($HgCl,NH_2$).

White Precipitate, Ammoniated Mercury. Prepared by decomposing a solution of corrosive sublimate by ammonia. It has weak caustic properties, and is only used externally as an ointment. It is extremely valuable as a remedy in various skin diseases, especially in eczema, [pediculosis, and tinea circinata].

It does not appear to be absorbed by the skin even after long use, as might also theoretically be deduced from its chemical properties.

Preparation :—

Unguentum Hydrargyri Ammoniati. (Ammoniated mercury, lard; gr. lxii. to ℥j., B.P.; gr. xl. to ℥j., U.S.) [A still weaker ointment, *e.g.*, gr. v.—xx. to ℥j., is very useful in the pustular eczema (Impetigo) of children.]

Antimonii Chloridi Liquor, B.P. ($SbCl_3+HCl$).

Butter of Antimony. A solution of terchloride of antimony in hydrochloric acid. It is a clear, yellowish, oily liquid, which is prepared by dissolving black sulphide of antimony with the aid of heat. Water precipitates the oxychloride ($SbOCl$). In using this caustic the part is first well dried, and then the liquor is applied with a brush, or it may be used as an ointment diluted with 5—10 pts. of lard.

Liquor Hydrargyri Nitratis, B.P., **(Acidus,** U.S.) ($Hg_2N_2O_6$).

Acid Nitrate of Mercury. Made by dissolving mercury in nitric acid. The salt itself is obsolete, but the solution is used to destroy nævi, &c., as a caustic, and also diluted with water as an injection, or lotion. [An excellent caustic for syphilitic growths as well as for lupus vulgaris. It should be applied with a glass brush. In lupus no after dressing is required, as the scab which forms is in itself a sufficient protection to the part. It may be used at intervals of ten days or a fortnight. Applied to the papules of acne simplex, and quickly dried with blotting paper, it arrests their further development.] As a stimulating ointment nitrate of mercury is officinal in the form of *Unguentum Hydrargyri Nitratis*, *Citrine Ointment.* (Mercury, nitric acid, lard, olive oil; 1 in 15½, B.P.; without olive oil and slightly stronger, U.S.)

Zinci Chloridum, B.P., U.S. ($ZnCl_2$).

Chloride of Zinc. A very deliquescent salt. It is chiefly used in the form of a paste, mixed with flour in various proportions, to destroy cancerous growths, and also the tubercles of hypertrophic lupus. The paste is rolled out to the necessary thickness, and allowed to remain on the part from 4—6 days. [Maisonneuve's "Flèches caustiques," or caustic arrows, consist of 1 pt. chloride of zinc, made into a paste with 3 pts. of flour and a little water, dried and cut into wedge-shaped pieces.

Preparation:—

Liquor Zinci Chloridi, B.P., U.S., Burnett's disinfecting fluid. A solution of chloride of zinc in distilled water. Chiefly employed as a disinfectant of fæces, &c. Sometimes used as an injection in cases of uterine cancer, 1 pt. diluted with 64 pts. water.]

CHAPTER XII.

MECHANICA.

MECHANICAL REMEDIES.

AMONG those Pharmacopœal remedies which are more or less exclusively used for mechanical purposes, we must concede to the ointments and their ingredients a certain amount of therapeutic effect, for, on the one hand, the absorption of various kinds of swellings may be promoted by the rubbing and kneading, which are necessary to their use; and on the other hand, these agents have a directly soothing effect upon irritated portions of skin. They often, however, only serve as a vehicle for the application of various other drugs. In addition to those which were treated of in the chapter on emollients, we must here enumerate the following:—

Adeps Præparatus, *Pig's Lard.* Containing about 60 per cent. of Olein, and the remainder Palmitin and Stearin.

Sevum Præparatum, *Prepared Suet.* Chiefly Stearin, with small quantities of Palmitin and Olein. It melts at 45° Cent.

Theobromæ Oleum, *Cacao Butter.* The basis of all the suppositories, melting at 30° Cent.

Cetaceum, *Spermaceti.* A fat, chiefly consisting of palmitic and cetylic æther, which is extracted from the skull bones of the sperm whale, Physeter macrocephalus. It melts between 45° and 50° Cent. The *Cetaceum saccharatum,* Pharm. Germ., consists of spermaceti rubbed up with three times its weight of sugar. It is given internally to allay cough.

Oleum Myristicæ Expressum, B.P., *Oil of Nutmeg.* A solid oil expressed from nutmegs with the aid of heat. It chiefly consists of Myristin, but also contains an æthereal oil, and some colouring matter. It melts between 45° and 48° Cent. It is used in the preparation of *Emplastrum Calefaciens*, and *Emplastrum Picis.*

The following drug is an important one :—

Glycerinum ($C_3H_8O_3$).

Glycerin. A triatomic alcohol. If fats are exposed to the action of superheated steam they take up water, and are decomposed into glycerin, and the corresponding acid. The same thing occurs if the fats are digested with water and alkaline bases, but in this case the acids which are set free combine with the bases, and form bodies, which, according to the solubility or insolubility of the base, are termed *Soaps* or *Plasters.* (It was in preparing simple lead plaster that Scheele discovered glycerin in 1779.) Glycerin is also separated when fats are treated with sulphuric acid.

Glycerin is soluble in water and alcohol in all proportions. A large number of bodies, which are insoluble, or only slightly soluble in *water*, *e.g.*, veratria, quinia, sulphur, iodine, and phosphorus are dissolved by it with greater or less facility. It may often be substituted with advantage for all the ordinary ingredients of ointments, not only owing to this behaviour to otherwise insoluble substances, but also because it is impossible for it to dry up, or become rancid, and so to excite irritation. It is not, however, entirely without irritating properties, and it causes pain if applied to ulcerated surfaces, mainly owing to its powerful affinity for water.

When powdered starch is heated with glycerin, it swells up, and advantage is taken of this property in the preparation of the officinal *Glycerinum Amyli*, B.P., a translucent jelly containing 1 part of starch in 8½. It is successfully employed in the treatment of skin diseases, either alone or in combination with other remedies. It must be entirely free from smell, and uniformly soft and translucent. Especial attention should be paid to these points before applying it to irritated surfaces.

Glycerin does not dissolve æther, chloroform, the resins, or the æthereal and fatty oils, and hence must not be ordered in combination with them.

The most important points to be attended to in examining the purity of glycerin for medical purposes are, the absence of an acid reaction when tested with blue litmus paper, of any odour or discoloration, and the presence of a purely sweet taste. Glycerin is used in the manufacture of artificial wines. [Glycerin is an excellent—perhaps the best—application to the skin in congenital xeroderma and ichthyosis.]

The following preparations of glycerin, some of which have been previously alluded to, are officinal, B.P. and U.S.:—

Glyceri $\left\{\begin{matrix}\textit{tum}\\ \textit{num}\end{matrix}\right\}$ *Acidi Carbolici.* (1 pt. acid in 4½.)

Glyceri $\left\{\begin{matrix}\textit{tum}\\ \textit{num}\end{matrix}\right\}$ *Acidi Gallici.* (1 in 4½.)

Glyceri $\left\{\begin{matrix}\textit{tum}\\ \textit{num}\end{matrix}\right\}$ *Acidi Tannici.* (1 in 4½.)

Glyceri $\left\{\begin{matrix}\textit{tum}\\ \textit{num}\end{matrix}\right\}$ *Boracis.* (*Sodii Boratis*, U.S.) (1 in 4½.)

The *Glyceritum Picis Liquidæ* (tar, glycerin, alcohol, water, carbonate of magnesia; 1 in 20), is only contained in the U.S. Pharmacopœia.

[**Pterocarpi Lignum,** B.P., *Red Sandal wood.* Obtained from Pterocarpus Santilinus (Leguminosæ), a native of Ceylon, is only used to colour *Liquor Arsenicalis* and *Tinctura Lavandulæ Composita.*

Staphisagriæ Semina (not officinal). The seeds of Delphinium Staphisagria, or *Stavesacre* (Ranunculaceæ). The fixed oil expressed from them is an excellent parasiticide, especially in *pediculi vestimentorum.* It is colourless, and less irritating than sulphur, and frequently has no irritant effect at all (B. Squire). Best used as an ointment; ʒj. to ℥j. lard; stiffened in warm weather with ʒss. white wax.]

The following ointments, which have not previously been mentioned, are also officinal:—

(1.) *Unguentum Simplex*, B.P. (White wax, almond oil, lard.)

(*a.*) *Unguentum*, U.S. (Lard, yellow wax.)

(*b.*) *Ceratum*, U.S. (Lard, white wax.)

(2.) *Unguentum Cetacei*, B.P., Spermaceti ointment. (Spermaceti, white wax, almond oil; 1 in 5.) *Ceratum Cetacei*, U.S. (Same with olive oil instead of almond oil; 1 in 9.)

(3.) *Unguentum Zinci*, Zinc ointment. (Oxide of zinc, benzoated lard; 1 in 6½, B.P.; 1 in 7, U.S.) [One of the most useful ointments for the treatment of eczema. It should be spread thickly and evenly upon lint, and firmly applied so as to exclude the air. For the relief of itching ʒj.—ij. of spirits of camphor may be added to each ounce.]

(4.) *Ceratum Zinci Carbonatis*, U.S. (Precipitated carbonate of zinc, simple ointment; 1 in 6.)

The following drug, which is only adapted for external use, may be inserted here:—

Resina.

Resin. The residue, after the distillation of the volatile oil, from the turpentine of Pinus Palustris and other species of Pinus.

Preparations:—

(1.) *Emplastrum Resinæ.* (Resin, 2 pts., lead plaster, 16 pts., hard soap, 1 pt., melted together; 1 in 9½, B.P.; resin, lead plaster; 1 in 7, U.S.) Adhesive plaster.

(2.) *Unguentum Resinæ*, B.P. (Resin, 2 pts., yellow wax 1 pt., simple ointment, 4 pts., melted and strained; 1 in 3½.)

(3.) *Ceratum Resinæ*, U.S., Basilicon ointment. (Resin, 10 pts., yellow wax, 4 pts., lard, 16 pts., melted and strained.)

(4.) *Ceratum Resinæ Compositum*, U.S. (Resin, suet, yellow wax, each 12 pts., turpentine, 6 pts., flax seed oil, 7 pts.; melted and strained.) The three last preparations are used as stimulant dressings.

The German Pharmacopœia contains a number of medicinal substances which have not been referred to under any previous heading. Those alone which have the letters B.P., U.S., appended to them are officinal in this country and America.

Argilla ($AlSi_2O_7$). White clay. A mixture of silicate of alumina, with other indifferent substances. It is occasionally used in pills as an excipient for such drugs as would be decomposed by organic substances.

Argentum et Aurum Foliatum, Silver and Gold leaf, used for coating pills.

Calcis Sulphas ($CaSO_4$).

Plaster of Paris. Sulphate of lime occurs in nature in the form of hydrated gypsum, and the latter when carefully heated loses about 20 per cent. of its water. When powdered and again mixed with water, it develops a certain amount of heat and rapidly becomes solid. The use of plaster of Paris in the form of bandages for the treatment of fractures is well known. We must be careful to avoid such plaster as by being over burnt, has assumed the crystalline structure of the anhydride on cooling, and no longer absorbs water. We should also reject any plaster that has been already wetted, and does not solidify properly on the further addition of water.

Carbonis Bisulphidum (CS_2).

Bisulphide of Carbon. This liquid, with its atrocious odour of garlic, has been recommended for the most various internal and external uses, but is at present almost exclusively retained as a solvent for gutta percha. [*Vide* also Note in Appendix A]. The evaporation of the bisulphide after the solution has been applied, renders the gutta percha available for stiffening bandages, &c.

Bisulphide of carbon is inflammable, and its vapour explodes when mixed with oxygen.

Coccus, B.P., U.S.

Cochineal. The dried female of the Coccus Cacti, an insect living upon cacti in Mexico and elsewhere. At one time it was reputed to be a specific for whooping-cough

(Rademacher), but it is now chiefly used to colour ointments and mixtures.

Preparation :—

Tinctura Cocci, B.P. (Cochineal, 1 pt., proof spirit, 8 pts.) *Dose*, ʒ ss.—iss.

Collodium $(C_{12}H_{14}(NO_2)_6O_{10})$.

Collodion. (Pyroxylin, 1 pt., æther, 36 pts., rectified spirit, 12 pts., B.P. ; pyroxylin, 1 pt., æther, 28 pts., rectified spirit, 8 pts., U.S.) The prepared wool used for making collodion chiefly differs from gun cotton in its solubility in æther, and in its smaller explosibility. In both cases its preparation depends upon the action of nitric acid upon fine cellulose (cotton wool), by which part of the hydrogen of the latter is replaced by nitrous acid (NO_2). The gun cotton contains rather more nitrous acid than the medicinal pyroxylin. Collodion is used as a dressing for wounds, and also to compress inflamed parts, *e.g.*, in erysipelas, mastitis, and orchitis. [It may sometimes be applied with advantage to protect the vesicles of herpes zoster, and also as a covering to chilblains]. If carefully applied in suitable cases it sometimes is extremely valuable for compressing vascular tissues to which it is not easy to adjust an ordinary bandage.

Collodion can easily be removed from the skin by means of acetic æther, in which it is much more soluble than in ordinary æther or alcohol.

Preparation :—

Collodium flexile, B.P., U.S. (Collodion, 48 pts., Canada balsam, 2 pts., castor oil, 1 pt.) Used for covering excoriated surfaces, burns, &c., and not for purposes of compression.

[**Pyroxylin,** B.P., U.S.

Gun Cotton. Prepared by immersing cotton, 1 pt., in a mixture of 5 pts. each of sulphuric acid and nitric acid, B.P.; sulphuric acid, 8 pts., nitric acid, 7 pts., by weight, U.S.; removing the acid by washing in cold water, draining and drying in a water bath. It is used in the preparation of *Collodium* and *Collodium flexile.*]

Dextrinum ($C_6H_{10}O_5$), *Dextrin.* Prepared by the action of acids on potato starch. It is sometimes employed for stiffening bandages. 1—2 pts. in 10 pts. water make a glutinous material which slowly solidifies.

[**Gossypium,** B.P., U.S.

Cotton Wool. A white filamentous substance separated from the seed of Gossypium Herbaceum, and of other species of Gossypium, carded and pressed into sheets. Used in making Pyroxylin, and also as a padding for splints, starch bandages, &c. It is far superior to ordinary lint as a dressing for wounds. In *fistula in ano* it is invaluable as a plug to check bleeding, and to keep the edges from adhering after operation.]

Gutta Percha Depurata, B.P., U.S.

Gutta Percha. Prepared from the juice of Isonandra Gutta (Sapotaceæ), from Upper India. It is probably mainly composed of hydrocarbons, allied to the turpentines. It is used in sheets about $\frac{1}{6}$ inch thick. When immersed in hot water, it becomes quite soft and pliable. It is also soluble in chloroform, æthereal oils, and bisulphide of carbon, and hence can be employed to stiffen various bandages. A solution of 1 pt. gutta percha in 10—15 pts. of chloroform is called *Traumaticin*, and is used to protect the surfaces of wounds without compressing them.

[Preparation:—

Liquor Gutta Perchæ, B.P., U.S. Solution of gutta percha (gutta percha, ℥j., is to be first dissolved in f℥vj. chloroform; ℥j. carbonate of lead is then mixed with ℥ij. of chloroform, and added to the gutta percha solution, and the whole is well shaken and allowed to subside. The clear liquid is alone used (*vide* Charta Sinapis).]

Hirudines, B.P., U.S.

Leeches. (Annulata.) Sanguisuga Medicinalis, and S. Officinalis, the former chiefly obtained from the marshes of Northern Europe, and the latter from those of Southern Europe. The quantity of blood which is withdrawn by each leech, and which flows from the wound spontaneously afterwards, varies very much with the size of the animal, and the duration of the after-bleeding, but the average quantity which a large leech will remove, may be reckoned at at least three drachms.

The way in which the leech extracts the blood out from the capillaries is by first dividing the skin with his three converging rows of teeth, and by then creating a vacuum by alternately dilating and contracting its muscular throat.

Laminaria.

Sea-tangle. The stem of L. Cloustini, and L. Digitata, a fucus which grows on the north coasts of Europe. The stem, which may be three feet and upwards in length, possesses the property, when dried, of swelling up considerably under the influence of heat and moisture, and it is used in the form of tents for dilating the *os uteri*, &c. Care should be taken that all irritating sea salt is thoroughly removed by maceration. The stem of the officinal gentian has been recommended for the same purpose.

Mastiche, B.P., U.S.

Mastich. A resinous exudation from artificial incisions in the bark of Pistacia Lentiscus (Terebinthinaceæ), a shrubby tree growing in the South of Europe. Used chiefly in the preparation of pills and plasters, and [as a solution in æther (4 : 1) applied on cotton wool as a temporary stopping for decayed teeth.]

Mel.

Honey. It consists chiefly of inverted sugar, a mixture of syrupy levulose (*fruit sugar*), and crystallisable dextrose (*grape sugar*), and also contains some acid substances, with lime and gum. When heated with water, filtered, and afterwards evaporated, the latter constituents are almost entirely removed. It is chiefly used as an addition to other medicines and as a vehicle for powders.

Preparations:—

(1.) *Mel Depuratum*, B.P.; *Despumatum*, U.S.; Clarified honey.

(2) *Mel Boracis* (Sodii Boratis). (Borax, 1 pt., clarified honey, 7 pts., B.P.; 1 and 8, U.S.) [Used to destroy the *oïdium albicans*, in infants' mouths, but is inferior to the glycerin of borax for that purpose.]

(3.) *Oxymel*, B.P. Clarified honey, acetic acid, distilled water.) *Dose*, ʒ j.—ij. This prepáration was formerly added wholesale to so-called "cooling" medicines. At present it forms part of the voluminous ballast which our laboratories have inherited from our forefathers.

(4.) *Mel Rosæ*, U.S. (Red rose, diluted alcohol, clarified honey.) *Dose, ad libitum.*

Saccharum Lactis, B.P., U. S. ($C_{12}H_{22}O_{11}$).

Sugar of Milk. Better adapted as an ingredient for powders than cane sugar, as it is not so liable to become damp by keeping, or to undergo acid fermentation in the stomach as the latter. In children with dyspeptic troubles this property may be of great importance, and in the case of infants, which are brought up by hand, and hence suffer from diarrhœa, it is sometimes sufficient to mix milk sugar with the food instead of cane sugar to procure normal motions. It does not, however, taste nearly as sweet as the latter.

[Saccharum Purificatum ($C_{12}H_{20}O_{11}$).

Refined Sugar. Ordinary cane sugar.

Preparation:—

Syrupus, B.P., U.S. (Refined sugar, 6 pts., distilled water, 3 pts.) An addition to various mixtures and pills, also contained in all the confections, syrups, and lozenges.]

Sapo.

Soap. Three such compounds of fatty substances with alkaline bases are officinal:—

(1.) **Sapo Animalis,** *Curd Soap.* A compound of soda with stearin.

(2.) **Sapo Durus,** *Hard Soap.* Chiefly oleate of soda $(NaC_{18}H_{33}O_2)_3$, prepared with olive oil and caustic soda (compare Glycerin). When given internally it is said to increase the secretion of bile, and also to accelerate the circulation in the branches of the *vena portæ*, but no reliable proofs of the correctness of this theory have been adduced. The *dose* is gr. v.—xv.

Preparations :—

(*a.*) *Emplastrum Cerati Saponis*, B.P. (Hard soap, bee's wax, oxide of lead, olive oil, vinegar.)

(*b.*) *Emplastrum Saponis.* (Hard soap, lead plaster, resin; 1 in 7⅙, B.P.; 1 in 10, U.S.)

(*c.*) *Ceratum Saponis*, U.S. (Soap plaster, yellow wax, olive oil; 1 in 8½.)

(*d.*) *Linimentum Saponis.* (Hard soap, camphor, oil of rosemary, rectified spirit, distilled water; about 1 in 10.)

(*e.*) *Pilula Saponis Composita*, B.P. (*Vide* Opium, p. 6.)

(3.) **Sapo Mollis,** *Soft Soap.* Green soap, made with olive oil and potash. [A solution of 2 pts. soft soap in 1 pt. alcohol, with the addition of ʒ j. spirits of lavender, forms Hebra's *Spiritus Saponis Alkalinus*, a valuable application in various chronic skin diseases.]

When soaps are diluted with a large quantity of water, they break up into an acid and a basic salt, the latter of which readily combines with free acids. Soap and water may therefore be recommended as an antidote, which is almost always likely to be at hand, in cases of poisoning by caustic acids.

Spongiæ Ceratæ.

Waxed Sponges. Flat discs of ordinary bath-sponge compressed and saturated with melted wax. They are sometimes used by surgeons to dilate orifices and cavities. The wax gradually softens at the temperature of the blood, and the sponge expands and so exerts a gentle pressure on the surrounding parts.

Spongiæ Compressæ, *Sponge Tents,* are pieces of the finest bath-sponge compressed into the form of cylinders, by twisting twine or thread tightly round them, and allowing them to dry. When the thread is removed and the tent is inserted into some orifice, *e.g.*, the *os uteri,* it expands and slowly dilates it.

Cera Alba, *White Wax.* Prepared by bleaching *Cera flava,* yellow bee's wax. The latter consists chiefly of palmitate of melissyl ($C_{30}H_{61},C_{16}H_{13}O_2$), insoluble in alcohol, and of free cerotic acid ($C_{27}H_{54}O_2$), which alcohol dissolves. Its melting point is between 62° to 64° Cent. Wax is contained in several ointments and plasters.

Tragacantha.

Tragacanth. A gum which exudes from the stem of Astragalus vera, and other species of Astragalus. It chiefly consists of Bassorin (*vide* Salep), and swells up into a jelly in water, without dissolving in it. It is used to suspend bismuth and other heavy powders in mixtures.

Preparations:—

(1.) *Mucilago Tragacanthæ,* B.P., U.S. (Tragacanth, ʒj., distilled water, ℥x.; 1 in 80, B.P.; 1 in 16, U.S.) *Dose,* ʒj., or more.

(2.) *Pulvis Tragacanthæ Compositus,* B.P. (Tragacanth, gum arabic, starch, refined sugar; 1 in 6.) *Dose,* gr. x.—lx.

[Ammoniæ (Ammonii) Nitras, B.P., U.S. (NH_4NO_3).

Nitrate of Ammonia. A white, deliquescent, crystalline salt, with a bitter taste. It dissolves in about half its weight of water at 70° Fahr. It fuses at about 320° Fahr., and between 400° and 450°, when heated in a glass retort, it is decomposed into *nitrous oxide gas* (N_2O) and water. It is introduced into the Pharmacopœias for the preparation of nitrous oxide gas, which is liquefied by pressure in iron bottles, and used for operations requiring anæsthesia of a few minutes' duration, especially by dentists. It is also available for making freezing mixtures (*vide supra*, p 245).]

[**Nitrous Oxide** (N_2O).

A transparent colourless gas, with a faint sweetish smell, prepared by heating nitrate of ammonia. Under a pressure of 50 atmospheres, at a temperature of 45° Fahr., it is reduced to a colourless liquid of sp. gr. 0·908. The chief impurities to avoid in making it are the other oxides of nitrogen (hyponitrous acid, &c.).*

It was first employed as an anæsthetic in 1844, by Dr. Horace Wells, of Hartford, Connecticut, U.S.A., who had a tooth extracted while under its influence. It was not, however, much used till 1863, when it was again brought into notice by Dr. Colton, since which time it has rapidly gained favour in the United States. It was introduced into England in 1868.

Physiological Action.—The exciting properties which led its discoverer, Sir Humphrey Davy, in 1800, to give it the name of "Laughing gas," are only manifested when nitrous oxide is inspired mixed with air. When inhaled pure, it appears to produce anæsthesia by taking the place of the normal respiratory oxygen, and so preventing the proper oxidation of the nervous centres; for though it contains more oxygen than atmospheric air, this oxygen is perfectly inert, and remains throughout in chemical combination with its nitrogen. The gas is taken up by the blood and circulates with it, but though, as proved by the spectroscope, it enters into combination with hæmoglobin, it does not part with any of its oxygen to the tissues, being expired as such unaltered. It does not, however, prevent the escape of carbonic acid from the blood, for if the expired gas be passed into lime water, a precipitate of carbonate of lime is thrown down.

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* Messrs. Coxeter, of Grafton-street East, London, who supply an excellent gas, inform the writer that the tests of its purity which they now employ are the appearance of the gas and its freedom from red fumes as it issues from the retorts, and the smell.

In producing anæsthesia by it the functions of the brain proper cease before those of the *medulla oblongata*. The respirations also cease before the heart's action. This has been invariably the case in experiments on animals, and the writer is not aware that any casualty which has occurred during the administration of the gas has invalidated this rule.

Administration.—The gas cannot be administered except with the aid of some special apparatus, an account of which would be beyond the scope of this work. It is frequently condensed into a liquid form in a strong iron jar, from which it escapes as gas on turning a tap. In this form it is most portable and convenient.

It must be given *pure*, without the slightest admixture of air, hence much care must be taken that the face piece of the inhaler fits accurately. In the cases of men with much beard it is well to soap it, so as to prevent air being drawn in under the face piece. The tube which brings the gas to the face piece should be of good size; one about one inch in diameter is usually used.

The patient requires no preparation before inhaling the gas. It has been given immediately after a meal without any unpleasant consequences; it is, however, better not to administer it very soon after food, as the dreams experienced under its influence may be unpleasant. Everything should be loose about the throat and chest, so that there shall be no impediment to respiration, and should any dangerous symptoms arise, artificial respiration and the other usual restorative measures should be at once resorted to. The patient should be told to breathe freely and deeply. After four or five respirations slight lividity appears on the forehead. Slight convulsive twitching of the hands and unsteadiness of the eyeball next occur, and the breathing, which had been previously quickened, now becomes slower, and in a few seconds slight stertor is noticed. At this point the gas is to be withdrawn, and the face will then be found intensely livid. There is often at this time considerable rigidity of the whole body, but it need not excite alarm. The pulse soon recovers its usual rate, and becomes full and regular. The condition of the pupil is usually unaffected. The entire inhalation occupies from 60 to 90 seconds.

Immediately on the withdrawal of the face piece the operation should be commenced, as the first full inspiration removes a great deal of the previous lividity, and absolute insensibility rarely lasts longer than 30 or 40 seconds. If it is desirable to prolong the narcosis, this can be done by reapplying the face piece before consciousness returns, and, when the patient is thoroughly under the gas, removing it again for four or five respirations, and again applying it, and so on.

Nitrous oxide appears to be by far the safest anæsthetic yet invented; well-authenticated deaths from its use being exceedingly rare, and it is probably now used much more frequently than any other anæsthetic. Although chiefly useful in dentistry, and in the short operations of general surgery, (removal of toenails, opening abscesses, &c.) it has been given in a number of major operations—among others amputation of the thigh, ovariotomy and strangulated hernia—but it is not well adapted for these operations, or for those which are followed by much pain, owing to the transient character of its effects.

In operations on the mouth, care should be taken that bleeding has quite ceased before the gas is inhaled a second time.

It may be given over and over again at the same sitting, but dentists now generally prefer not to give the gas more than twice at one sitting, and this appears to be a judicious precaution.

It has been given at all ages, to the feeble and to the strong, as well as to people suffering from the most various diseases; still it would be unadvisable to administer it in cases of advanced lung disease (especially when there is much difficulty in breathing), in advanced heart disease, or in acute disease of the heart and lungs.

The after-effects are as a rule absolutely *nil*, and the patient is able to get up and walk away a few minutes after the inhalation. There is no nausea or vomiting. In a few cases there is a tendency to faintness. More rarely headache occurs, and in some cases hysterical symptoms are met with, which however rarely last long. It must not be forgotten that no anæsthetic is likely to be found absolutely free from danger, and even nitrous oxide should never be given except in the presence of a qualified medical man.

Nitrous oxide is now also frequently administered in combination with æther, by an ingenious, though necessarily complicated, apparatus invented by Mr. Clover early in 1874. The gas is first turned on until the patient is nearly under its influence, and then anæsthesia is continued and kept up by æther. Should it be at any time desirable owing to returning consciousness to render the patient quickly insensible to pain, nitrous oxide can be again turned on. This combination is applicable to all operations, it does away with the unpleasantness of æther, it is more rapid in its effects than either æther alone or chloroform, and is safer than chloroform.]

The following drugs although possessing some astringent properties are chiefly employed for mechanical purposes:—

Rosæ Caninæ Fructus, B.P.

Hips. The receptacle of the dog rose, without the seeds. Used as a mild astringent in diarrhœa, and in the following form as a basis for pills.

Preparation :—

Confectio Rosæ Caninæ. (Hips, refined sugar; 1 in 3.) *Dose*, ʒj. and upwards.

Rosæ Gallicæ Petala, B.P., U.S.

Red Rose Petals are credited with slight astringency, and are also used to colour other medicines. They are contained in *Pilulæ Aloes et Mastiches*, U.S.

Preparations :—

(1.) *Confectio Rosæ*, U.S., *Rosæ Gallicæ*, B.P. (Red rose petals, refined sugar; 1 in 4, B.P.; the same with honey, and rosewater; 1 in 12, U.S.) *Dose*, ʒss.—ij. and upwards.

(2.) *Infusum Rosæ Acidum*, U.S., *Compositum*, B.P. (Red rose petals, dilute sulphuric acid, boiling distilled water; 1 in 40, B.P.; the same with sugar; 1 in 80, U.S.) *Dose*, ℥j.—iv.

(3.) *Syrupus Rosæ*, B.P., *Rosæ Gallicæ*, U.S. (Powdered red rose petals, sugar, boiling water; 1 in 17¼, infused, B.P.; rose petals, sugar, diluted alcohol, water; 1 in 14, percolated, U.S.) *Dose*, ʒss.—ij.

The remaining substances scarcely need more than a passing enumeration.

Aqua Destillata, B.P., U.S.

Distilled Water. Prepared by distilling water, and condensing it in a block tin or glass apparatus. It should be absolutely free from taste, smell, or colour, and leave no residue on evaporation.

Ferri Sulphuretum (FeS), U.S.

Sulphide of Iron. Is used for preparing sulphuretted hydrogen; as is also

Antimonium Nigrum, B.P.

Antimonii Sulphuretum, U.S. Native tersulphide of antimony.

Lac, B.P.

Cow's Milk. Used to prepare *Mistura Scammonii.*

Marmor Album, B.P., U.S.

White Marble. Granular, white carbonate of calcium ($CaCo_3$). Used for making carbonic acid gas by the action of a mineral acid.

Mica Panis, B.P.

Bread Crumb. Used as an ingredient in *Cataplasma Carbonis,* and as a basis for pills.

Ovi Vitellus, B.P., U.S.

The yolk of the egg of Gallus Bànckiva, or Gallus Phasianus, *Common fowl.* An ingredient in *Mistura Spiritûs Vini Gallici*, B.P., and used in preparing *Mistura Chloroformi*, U.S.

Theriaca, B.P.

Treacle. The residue left from the crystallisation of sugar, is chiefly used as a basis for pills, *e.g.*, in *Pilula Assafœtidæ Co.*, *Pilula Rhei Co.*, and *Pilula Scillæ Composita.*

Uvæ, B.P. **Uva Passa**, U.S.

Raisins. The dried ripe fruit of Vitis Vinifera, *Grape Vine* (Vitaceæ). Contained in *Tinctura Cardamomi Co.*, *Tinctura Sennæ*, and *Tinctura Rhei et Sennæ*, to sweeten and flavour them.]

APPENDIX A.*

Note to page 14. (*Linimentum Belladonnæ.*)

Belladonna liniment, applied to the skin, *e.g.*, of the *mamma*, may give rise to local eczema. This should be remembered in dealing with persons with delicate skins.

Note to page 26. (*Colchicum.*)

Colchicin has lately been strongly recommended in chronic rheumatism of the joints, and in rheumatic neuralgia, as a subcutaneous injection (·002 : 1·0 Aq.), in the absence of fever (Heyfelder).

Note to page 33. (*Chloral Hydras.*)

Chloral should be given with great caution to patients with cardiac disease (Rosenstein).

The prolonged use of chloral is sometimes followed by patches of simple erythema, or by urticaria, which disappears on the withdrawal of the drug; but cases occur in which actual scarlatinoid inflammation of the skin results, with swelling of the parts, itching, burning, and protracted desquamation.

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* The Translator is entirely responsible for the notes in this Appendix.

Note to page 42. (*Potassii Bromidum.*)

According to Hammond, bromide of calcium (gr. x.—xv., *ter die*) and bromide of sodium (gr. x.—xxx.), are both valuable in epilepsy. The latter salt disturbs the digestion less than bromide of potassium. Bromide of calcium is expensive.

Acidum Hydrobromicum (HBr) (not Officinal).

Hydrobromic Acid. A colourless liquid, prepared by acting on a solution of bromide of potassium with tartaric acid (Milner Fothergill), or better (since in the first process all the bromide is not decomposed by the tartaric acid), by acting on an aqueous solution of bromine with sulphuretted hydrogen :—

$$10\ Br + 2H_2S + 4H_2O = 10\ HBr + H_2SO_4 + S.$$

The solution prepared by Fothergill's formula contains about 9 per cent. of real acid, and ♏viij. will dissolve gr. v. sulphate of quinia with the aid of a little water (Martindale).

Use.—Hydrobromic acid has been recommended of late as a solvent of quinia. It is stated that patients can often take quinia in combination with the acid, when it caused headache, ringing in the ears, and other symptoms of cinchonism, if given alone. *Tinnitus Auriûm*, unattended with marked organic disease, is relieved by hydrobromic acid ♏xv., *ter die*, or oftener (Woakes, Lennox Browne). Hysterical insomnia has also been benefited by it. *Dose*, of Fothergill's solution for an adult, ♏xv.—ʒj.; for a child, ♏v.—x.

Hydrobromate of Quinia. Made by treating bromide of potassium (Latour) or bromide of barium (Boille) with acid sulphate of quinia, contains a larger proportion of quinia than neutral sulphate of quinia, and is *six* times as soluble in water. It is hence adapted for subcutaneous injection (1 : 10 Aq.), especially as it causes no local irritation. According to Gubler, the hydrobromate combines the properties of hydrobromic acid and quinia. In large doses, it induces cinchonism with muscular languor, and a strong inclination to sleep. It has been given with success in hysteria, intermittent fever, &c. *Dose*, gr. iss., six grains are an average dose for one day.

Note to Page 120. (*Coto Bark.*)

This bark was first imported into Europe by Rudolph, Martens, and Co., of Hamburg, and was obtained from the so-called "missions" in the interior of Bolivia, which also supply cinchona bark. It costs about the same price as the latter. It is imported in flat, or curved, irregularly fractured pieces, ·2—·3 metre long, or less, and 8—14 millimetres thick. The parenchymatous cells of the inner bark contain a colourless, or slightly yellow, mixture of resin and essential oil, soluble in æther, alcohol, &c. After extraction by æther, this mixture appears at ordinary temperatures as a thick fluid, but it often solidifies during evaporation, and forms colourless prismatic needles resembling camphor in appearance and smell.

According to Wittstein, the principal constituents of coto bark are:—

(1.) A pale yellow *essential oil*, with a taste like peppermint.

(2.) A *volatile alkaloid*, resembling propylamine or trimethylamine.

(3.) A soft yellowish brown *aromatic resin*, soluble in æther and alcohol, and forming about one-seventh of the entire weight of the bark.

(4.) A dark brown *hard resin*, soluble in alcohol, and forming about one-tenth of the entire weight of the bark.

The bark also contains tannic acid, starch, gum, oxalate of lime, and other indifferent substances.

Cotoin, a crystallisable constituent of the bark, which has been isolated by Jobst, is a body resembling commercial gallic acid in colour, and which consists of minute quadrate prisms. If slowly deposited from an alcoholic solution, it can easily be obtained in large sulphur yellow prisms melting at 124° Cent.

Cotoin readily dissolves in æther, chloroform, benzine, and other hydrocarbons; alkalies also dissolve it, and form a yellow solution from which it is again precipitated by acids.

Cotoin is prepared by treating an æthereal extract of the bark with hot petroleum æther, allowing the æthylic æther to evaporate, and recrystallising the crystals which form several times with hot water. Jobst assigns the empirical formula, $C_{22}H_{18}O_6$ to cotoin. Cotoin has the biting taste and penetrating smell of the bark, and forms a blood-red solution when boiled with concentrated HNO_3, whereas an homologous body, paracotoin (Jobst and O. Hesse), $C_{19}H_{12}O_6$, obtained from what was stated to be a sample of the best commercial coto bark, has neither of these properties; gives no precipitate with basic acetate of lead; and is much less soluble in alcohol, alkaline solutions, &c., than cotoin. Two other crystallisable principles, oxyleucotin ($C_{21}H_{20}O_7$) and leucotin ($C_{20}H_{21}O_6$), have been extracted from the bark. Their action resembles that of cotoin and paracotoin, but is far weaker.

Dr. von Gietl has made a number of experiments with coto bark at Munich, giving 0·5 gramme of the powdered bark, 4—6 times a day, or ♏x. of a tincture (1 in 10), *secundis horis*, in various forms of diarrhœa, and considers it a specific. The only drawback to its use was the occasional occurrence of so much nausea, vomiting, and gastric pain, from the presence of the above-mentioned soft acrid resin, and essential oil, that the patients refused to take it any more. Cotoin and paracotoin, which appear to be its active principles, are, however, free from this defect, while both, and especially the former, possess the anti-diarrhœic properties of coto bark even in very small quantities (Burkart). They have been used with success in the acute intestinal catarrh of adults and children, and in the diarrhœa of phthisis, parametritis, &c. In some of the phthisical cases the evening febrile exacerbation (38·5°—39·0° Cent.) disappeared with the arrest of the diarrhœa. The *dose* of powdered cotoin is 0·05—0·1 and of paracotoin 0·1 or more, five or six times a day. Both of them can be detected in the urine in 4—10 hours, and cotoin tinges it of a wine red colour.

The position of coto bark under the head of astringents in this work is merely provisional, and the effect of the bark is probably to be referred to its stimulant action on the intestinal nerves, and to the tone thus imparted to the muscles of the bowel (Burkart.)

Note to page 122. (*Argenti Nitras.*)

Nitrate of silver, in pills (gr. $\frac{1}{60}$, *ter die*), is recommended by Botkin in abnormal irritability of the heart) palpitation, &c.). He begins with the above dose, and increases it by *one* pill every three or four days, until he reaches gr. $\frac{1}{6}$ *per diem.* Then he rapidly reduces the dose.

Note to page 207. (*Quinia.*)

Quinia Rash.

The following symptoms have been observed after the use of quinia in several unequivocal cases (Köbner, Pflüger, Skinner, Scheby-Buch, and others):—

Two or three hours after doses of sulphate of quinia, ranging from 0·025 to 1·0 gramme, there was a severe rigor, accompanied with nausea, a sensation of choking, severe headache, and even slight delirium. The temperature rose in all (in one case to 39·8 Cent.). Shortly afterwards, the patients complained of a burning feeling, and of itching all over the body, succeeded by the outbreak of a dark red scarlatinous eruption, either limited to the face, or extending over the head and the whole of the rest of the body. There was swelling of the face and arms.

The rash lasted several days, eight being the longest period, and was followed by universal desquamation of epidermis, large lamellar flakes being sometimes detached from the palms and soles. In one case, the desquamation lasted *twelve* weeks.

The same set of symptoms has been reproduced several (in one case *four*) times in the same patient.

Note to page 299. (*Carbonis Bisulphidum.*)

Bisulphide of carbon is said to be useful in spreading chronic ulcers, especially those of a syphilitic nature (Doering). The surface of the ulcer should be lightly brushed with it, and then covered with some dusting powder, *e.g.*, starch. The severe pain caused by the contact of the bisulphide rapidly subsides.

APPENDIX B.

THE following table, which is founded on one appended to the United States Pharmacopœia, will be found useful in converting doses expressed in metrical weights into the equivalent weights in grains, drachms, &c. :—

			Exactly in grains.	Approximately.
One gramme, or	1·0	=	15·434	gr. xv.
One decigramme, or	0·1	=	1·543	gr. iss.
One centigramme, or	0·01	=	0·1543	gr. $\frac{1}{6}$.
One milligramme, or	0·001	=	0·0154	gr. $\frac{1}{65}$.

Grammes.				Approximately.
2	or	2·0	=	ʒ ss.
4	or	4·0	=	ʒ j.

Decigrammes.				Approximately.
2	or	0·2	=	gr. iij.
4	or	0·4	=	gr. vj.
6	or	0·6	=	gr. ix.

Centigrammes.				Approximately.
2	or	0·02	=	gr. $\frac{1}{3}$.
3	or	0·03	=	gr. $\frac{6}{13}$.
5	or	0·05	=	gr. $\frac{3}{4}$.
7	or	0·07	=	gr. j.

Milligrammes.				Approximately.
2	or	0·002	=	gr. $\frac{1}{32}$.
3	or	0·003	=	gr. $\frac{1}{22}$.
4	or	0·004	=	gr. $\frac{1}{16}$.
5	or	0·005	=	gr. $\frac{1}{13}$.
7	or	0·007	=	gr. $\frac{1}{9}$.
8	or	0·008	=	gr. $\frac{1}{8}$.
9	or	0·009	=	gr. $\frac{1}{7}$.

No table is necessary for converting metrical into common measures, as all medicines prescribed according to the metric system, are *weighed*, and not measured; but it may be well to remember that

1 litre = 35¼ fluid ounces, B.P., or 2·113 pints, U.S., approximately.

N.B.—One pint (Oj.) is equal to twenty fluid ounces, B.P., *sixteen* fluid ounces, U.S. Pharm. The latter Pharmacopœia uses the Troy ounce of 480 grains, and the Troy pound of 12 ounces, whereas the British has the Avoirdupois ounce of 437·5 grains, and the Avoirdupois pound of 16 ounces. The weights of the *fluid ounces*, B.P. and U.S., are 437·5 grains and 455·7 grains respectively.

Conversion of temperatures expressed in degrees Fahrenheit into degrees Celsius (Centigrade), and *vice versâ*, may be readily effected by the following formulæ :—

Fahrenheit to Centigrade, $\frac{5}{9}$ (F.° − 32) = C.°
Centigrade to Fahrenheit, $\frac{9}{5}$ C.° + 32 = F.°

Thus, if we wish to know what degree Fahrenheit corresponds to 37° Centigrade, since a Centigrade degree equals $1\frac{4}{5}°$ or $\frac{9}{5}°$ Fahrenheit, we multiply 37 by 9, and divide the product by 5, which gives 66·6° nearly. To this, however, must be added 32, or the number of degrees Fahrenheit *below* the freezing point of water (zero Centigrade)—the Fahrenheit zero being an arbitrary one. This gives 98·6° as the degree Fahrenheit, which approximately represents 37° Centigrade.

Degrees Centigrade below zero (32° Fahrenheit) have the *minus* sign before them. Thus − 2° Cent. = (32 − 3·6) = 28·4° Fahrenheit.

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ERRATA.

[Page 80. The dose of Valerianate of Soda is gr. j.—v.

Page 77 (Æthereal Oils). The following drugs should be inserted here :—

Anethi Fructus, B.P., *Dill Fruit.* The fruit of Anethum graveolens (Umbelliferæ), cultivated in England, or imported from Middle and Southern Europe. They contain an æthereal *Oleum Anethi*, *dose*, ♏j.—iv., which resembles the other æthereal oils in its general properties.

Preparation :—

Aqua Anethi (1 in 10), Dill Water. *Dose,* ℥ ss.—j. Chiefly used in the flatulent colic of infants.

Pimenta, B.P., U.S., *Pimento.* The dried unripe berries of Eugenia Pimenta, *Allspice-tree* (Myrtaceæ) from the West Indies. They contain an æthereal *Oleum Pimentæ,* B.P., U.S., *dose,* ♏j.—iij., and are reputed to be stimulant and carminative. They are contained in *Syrupus Rhamni,* B.P. *Dose,* of the powdered leaves, gr. x.—xxx.

Preparation :—

Aqua Pimentæ, B.P. (1 in 11½). *Dose,* ℥ j.—ij.

Page 121 (Astringents). Here belong

Maticæ Folia, B.P., U.S., *Matico Leaves.* The dried leaves of Artanthe elongata (Piperaceæ), from Peru. They contain an aromatic æthereal oil, allied to oil of turpentine, and are chiefly used in the form of *Infusum Maticæ,* B.P. (1 to 20), as a styptic in vesical hæmorrhage. ℥ ij. should be given every three hours (H. Thompson). Matico may also be of service in chronic vesical catarrh. *Dose* of the powdered leaves, gr. xxx.— ʒ ij. *ter die.*

Preparation :—

Extractum Matico Fluidum, U.S. (1 in 1). *Dose,* ♏v.—x.

Page 187 (Diathetic Remedies).

Hemidesmi Radix, B.P. The dried root of Hemidesmus Indicus, *Indian Sarsaparilla.* It is supposed to possess tonic, diuretic, diaphoretic, and alterative properties, but nothing definite is known about it, and it is chiefly used as a flavouring material, because of its pleasant smell and taste.

Preparation :—

Syrupus Hemidesmi (Hemidesmus root, sugar, water; 1 in 8). *Dose,* ʒ j.—ij.

Page 251 (Purgatives).

Mori Succus, B.P., *Mulberry Juice.* The violet-coloured juice of the ripe fruit of Morus Nigra, *Common Mulberry* (Urticaceæ). It is said to be slightly laxative, but is scarcely used except as a colouring material in the form of *Syrupus Mori* (Mulberry juice pts. 20, refined sugar 32, rectified spirit 2½, evaporated to a liquid of sp. gr. 1·330). *Dose,* ʒ j.—ij.

Page 260 (Purgatives).

Cassiæ Pulpa, B.P., U.S., *Cassia Pulp,* obtained from the pods of Cassia fistula, and Marilandica, *Purging Cassia* (Leguminosæ), imported from the East or West Indies. It forms a viscid, sweetish mass, of a brownish black colour, and is laxative in small doses (ʒ j.—ij.), and purgative, with nausea and griping, in large ones (℥ —ij.) It is contained in *Confectio Sennæ.*]

CORRIGENDA.

Page 24, line 11 from top, *read* "Anemonin" *for* "Anemorin."
Page 54, line 12 from top, *read* "on" *for* "in."
Page 77, line 8 from bottom, *read* "℥ j.—ij." *for* "ʒ j.—ij."
Page 101, line 7 from top, *read* "Ammoniac" *for* "Ammonia."
Page 143, line 8 from bottom, *read* "8" *for* "9."
Page 162, line 8 from bottom, *dele* ")" after "iron."
Page 175, line 10 from top, *read* "Flava" *for* "Flavi."
Page 211, line 2 from top, *dele* "," after "system."
Page 222, line 5 from top, *read* "Gaethgens" *for* "Gaethgeus."
Page 286, bottom line, *read* "in" (ordinary type) *for* "*in*" (italics).

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